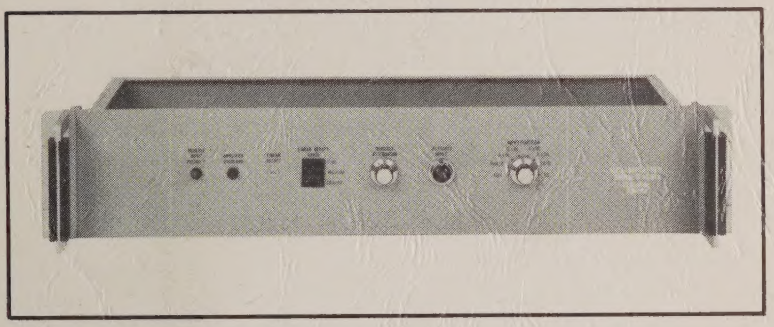
Instruction Manual

Model 1587
DC Amplifier



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MODEL NO. _____

SERIAL NO. _____

MODEL 1587
DC AMPLIFIER

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FIRST EDITION, REVISED
FEBRUARY, 1979

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CHAPTER 1
GENERAL INFORMATION

1.1 GENERAL

1.1.1 This instruction manual contains information for the installation, operation, and maintenance of the Scientific-Atlanta Model 1587 DC Amplifier. Replacement parts lists, schematic diagrams and parts location information are also included. It is recommended that, before operating, adjusting, or repair is attempted, the appropriate section of this manual be read carefully. Factory or customer specified modifications to the equipment (when applicable) are described in a Modification Notice envelope located before the back cover of this instruction manual.

1.2 PURPOSE OF EQUIPMENT

1.2.1 The Model 1587 DC Amplifier is an accessory unit intended for use as a preamplifier with the Series 1580 Pattern Recorder. This unit is a sensitive amplifier which can accept inputs from either a microwave receiver or other test and indication equipments. Output signals are provided to the Series 1580 Pattern Recorder for recording purposes.

1.3 GENERAL DESCRIPTION

1.3.1 The Model 1587 DC Amplifier accepts dc input voltages from sources such as a Scientific-Atlanta Series 1820 Digital Phase Display or a Series 1833A Logarithmic Ratiometer.

Similarly, the AUXILIARY INPUT connector (J2) will accept dc alalog voltages, either unipolar or bipolar, with offset voltages up to 100 volts. Input signals are amplified or attenuated, as necessary, to provide a properly conditioned output signal at a format level acceptible by the Series 1580 Pattern Recorder. Front panel controls provided on the Model 1587 DC Amplifier condition the internal circuits to operate with a wide variety of input signals while front panel indicators alert the operator to conditions such as Amplifier Overload and Reverse Input Polarity.

1.3.2 The overall technical specifications of the Model 1587 DC Amplifier are listed in Table 1-1.

Table 1-1
Technical Specifications
Model 1587 DC Amplifier

Feature	Comments
Operation	Manual
Dimensions (Excluding Connectors)	Height: 3.5 inches (8.8 cm) Width: 19 inches (48.2 cm) Depth: 8 inches (20.2 cm)
Weight	Net: 9 lbs (4 kgs) Shipping: 15 lbs (7 kgs)
Power Supply Requirements (Normally supplied by the Series 1580 Pattern Recorder	±15V dc at 100 mA +5V dc at 20 mA

Table 1-1 - continued

Feature	Comments
INPUT CHARACTERISTICS	(The following features are front panel selectable or as noted.)
Type	Differential (balanced)
Range	0.10 to 10.0 volts dc full scale
Common Mode Offset Voltage	From 0 to 100 volts
Polarity	Plus, Minus, or Bipolar (±5V max. Bipolar)
Average Noise	100 microvolts
OUTPUT CHARACTERISTICS	
TO RECORDER Connector (J6)	Interfaces directly with the CBA/DCA Interface printed circuit board (Part No. 158391) used in the Series 1580 Pattern Recorder
DC Output Connector (J3)	Analog dc output signal from 0 volt to +10 volts maximum

CHAPTER 2
INSTALLATION

2.1 GENERAL

2.1.1 The Model 1587 DC Amplifier is normally mounted as near the Series 1580 Pattern Recorder as possible. A typical example is shown in Figure 2-1 where the Model 1587 DC Amplifier is mounted in a standard 17-inch high Optima® cabinet together with a Series 1580 Pattern Recorder and a Model 1588 Synchro Selector unit. This arrangement is within the interconnecting cable assembly length limits while providing a compact package of test equipment.

2.1.2 If the Model 1587 DC Amplifier is purchased separately, it is normally shipped complete in one carton. Carefully open the carton and inspect the equipment for shipping damage. If the equipment is damaged, file a claim with the carrier and also notify the nearest Scientific-Atlanta representative immediately. Do not return the equipment until shipping instructions are received from the factory.

2.2 INSTALLATION

2.2.1 A Model 1587 DC Amplifier is provided with two cable assemblies for interconnection with the Series 1580 Pattern Recorder. Figure 2-2 is a simplified interconnection diagram illustrating the functions of front and rear panel connectors. The Range and Voltage Cable Assembly, Scientific-Atlanta Part No. 158478, and the Analog Signal Coaxial Assembly, Scientific-Atlanta Part No. 163033, are designed to mate with connectors provided on the CBA/DCA Interface printed circuit

Figure 2-1. Typical Arrangement Using a Model 1587 DC Amplifier and Model 1588 Synchro Selector With the Model 1581 Pattern Recorder in One Cabinet

board contained in the Series 1580 Pattern Recorder. A selected input device can be interconnected using either the front or rear panel INPUT connectors (J1 or J2).

2.2.2 The Range and Voltage Cable Assembly provides both operating voltages from the Series 1580 Pattern Recorder and signal commands for automatic range selection of the Model 1587 DC Amplifier circuits. The properly conditioned amplified input signal is connected to the Series 1580 Pattern Recorder through the Analog Signal Coaxial Cable Assembly.

2.2.3 The amplified input signal can also be monitored on separate high impedance external equipment by using coaxial cables to the BNC panel connector J3 DC OUTPUT.

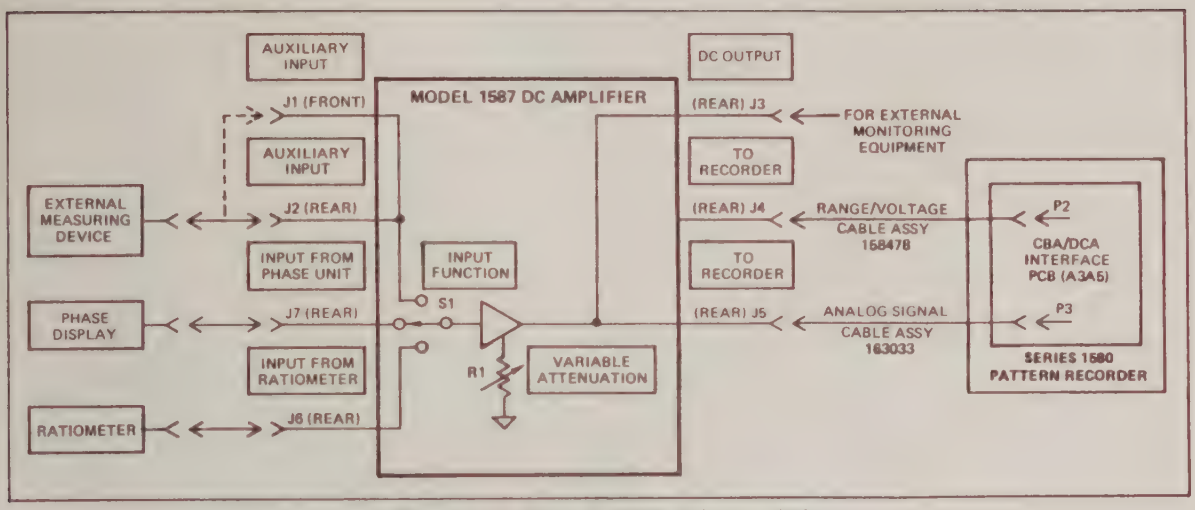

Figure 2-2. Model 1587 DC Amplifier, Interconnection Diagram

CHAPTER 3
OPERATION

3.1 GENERAL

3.1.1 The operation of the Model 1587 DC Amplifier is automatic after initial adjustments to front panel controls for compensation with a selected input service. Automatic operation is provided in response to commands from the Series 1580 Pattern Recorder microprocessor and program memory functions. The commands are provided through the Voltage and Range Cable Assembly, Scientific-Atlanta Part No. 158478, and the properly conditioned signal input is provided through Analog Signal Cable Assembly, Scientific-Atlanta Part No. 163033.

3.2 INITIAL ADJUSTMENTS

3.2.1 Table 3-1 provides a functional description of the front panel controls. Table 3-2 provides a functional description of the rear panel connectors. All descriptions are general because of the many possible input devices which may be selected.

3.2.2 Use the following tables to adjust the Model 1587 DC Amplifier controls to operate properly with a selected input device.

Table 3-1
Model 1587 DC Amplifier
Front Panel Controls and Indicators
(See Figure 3-1)

Figure 3-1 Reference	Control/ Indicator	Function
1	REVERSE INPUT POLARITY Indicator	A LED lamp that illuminates to indicate incorrect signal polarity is connected to an INPUT connector.
2	AMPLIFIER OVERLOAD Indicator	A LED lamp that illuminates to indicate the signal input level is exceeding the design full scale level.
3	LINEAR OFFSET Variable Control	A screwdriver adjustable potentiometer that provides offset of the input bipolar signal voltage established by the LINEAR OFFSET RANGE switch.
4	LINEAR OFFSET RANGE Switch (FINE, MEDIUM, COARSE)	This three-position lever switch allows for offset resolution with varying bipolar input signal levels. FINE position: Connects the LINEAR OFFSET potentiometer to provide offset for an input signal voltage range of 0 volt to ±0.1 volt. MEDIUM position: Connects the LINEAR OFFSET potentiometer to provide offset for an input signal voltage range of 0 volt to ±0.5 volt. COARSE position: Connects the LINEAR OFFSET potentiometer to provide offset for an input signal voltage range of 0 volt to ±5.0 volts.

Table 3-1 - continued

Figure 3-1 Reference	Control/ Indicator	Function
5	VARIABLE ATTENUATOR Control	This 10-turn potentiometer allows for the adjustment of the input signal level to drive a recorder pen system to full scale. This potentiometer has a linear range of at least 20 dB.
6	AUXILIARY INPUT Connector	A three-pin signal input connector provided on the front panel for operator convenience and parallel connected to the rear panel AUXILIARY INPUT connector (J2). Signals applied through this connector are controlled by the INPUT FUNCTION switch.
7	INPUT FUNCTION Rotary Switch	An eight position rotary switch that selects the desired electronic conditioning of an input signal before it is applied to a pattern recorder pen system. The AUX switch position conditions polar or bipolar input signals from either front or rear panel AUXILIARY INPUT connectors. Source input signals must not exceed 0 to 10 volts polar or 0 to ±5 volts bipolar for normal operation. The PHASE switch position permits conditioning of input signals from phase sensitive equipment such as a Model 1823A Digital Phase Display through the rear panel INPUT FROM PHASE UNIT connector (J7). The remaining six switch positions accommodate the conditioned amplitude and ratio related input signals from equipment such as the Series 1830 Digital Amplitude Display through the rear panel INPUT FROM RATIOMETER connector (J6).

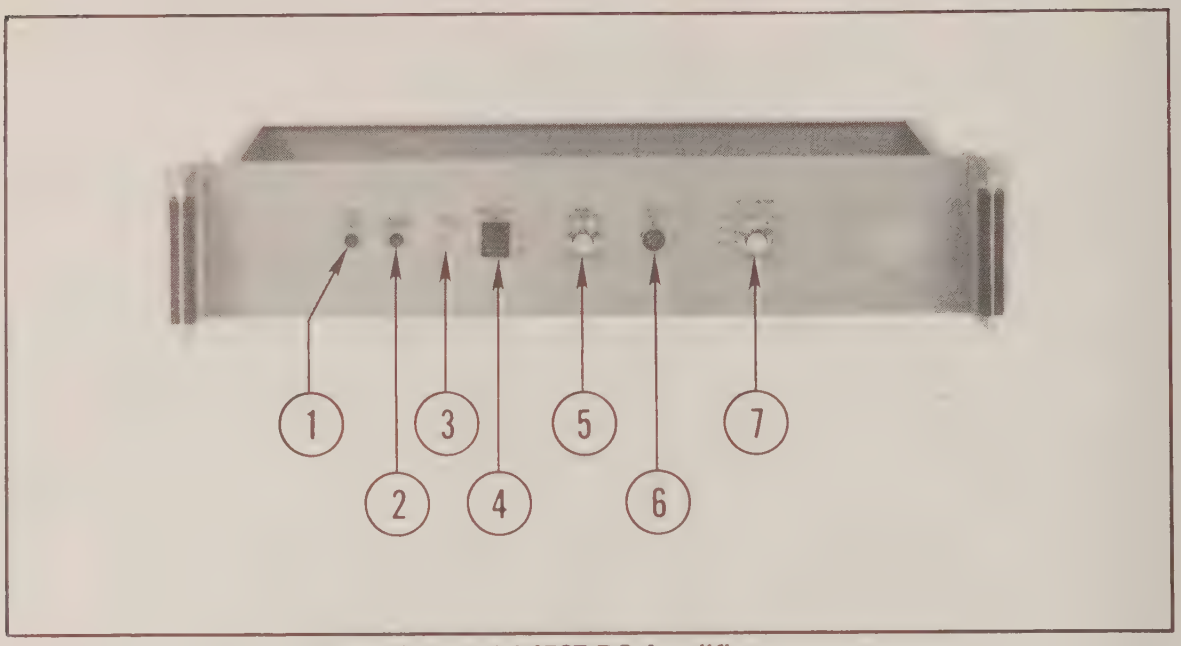

Figure 3-1. Model 1587 DC Amplifier,
Front Panel Controls and Indicators

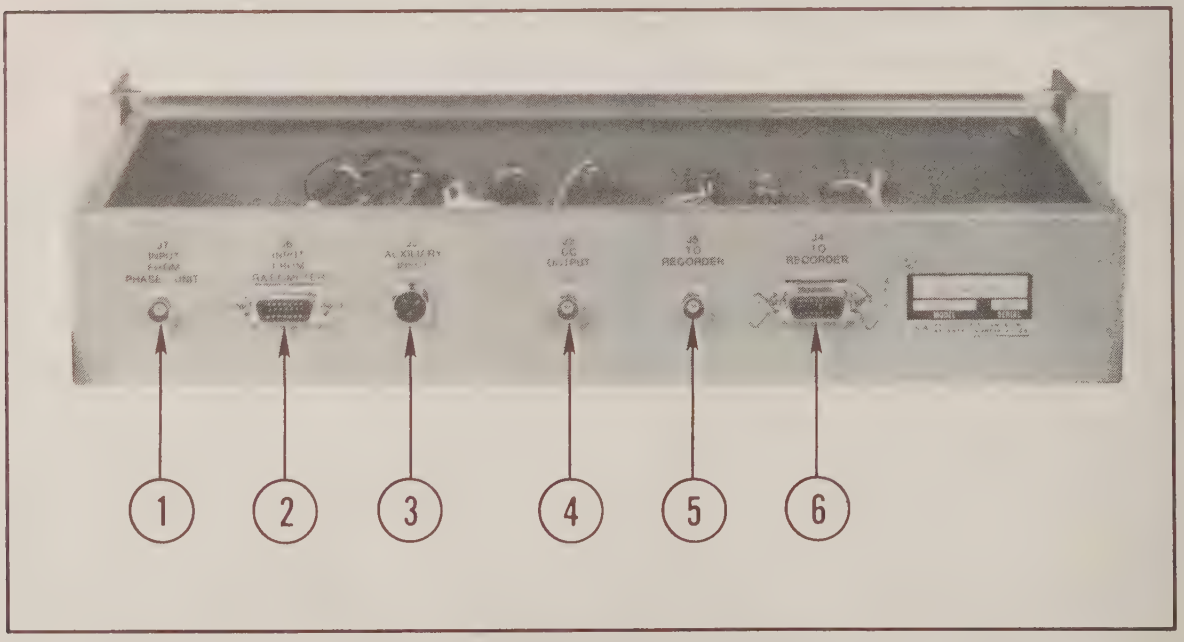

Figure 3-2. Model 1587 DC Amplifier,
Rear Panel Connectors

Table 3-2
Model 1587 DC Amplifier
Rear Panel Connectors
(See Figure 3-2)

Figure 3-2 Reference	Connector	Function
1	INPUT FROM PHASE UNIT (J7) Connector	An isolated BNC-type* connector provided for applying an input from phase measurement equipment such as a Model 1823A Digital Phase Display unit.
2	INPUT FROM RATIOMETER (J6) Connector	A dual in-line connector with locking clips to provide input connections for the functions generated by amplitude measurement equipment such as a Series 1830 Digital Amplitude Display. The functions provided through this connector are listed below: Pin 1 - Ratio Input (A/B) Pin 2 - Not Used Pin 3 - CHAN A Log Input Pin 4 - CHAN A Lin Input Pin 5 - CHAN B Log Input Pin 6 - CHAN B Lin Input Pin 7 - Ground Pin 8 - Product Input (A·B) Pins 9 through 13 - Not Used Pin 14 - Ground
3	AUXILIARY INPUT (J2) Connector	A three-pin signal input connector normally used to interface auxiliary equipment not identified in this manual. Input signals through this connector are selected by the front panel INPUT FUNCTION switch.
4	DC OUTPUT (J3) Connector	An isolated BNC-type* connector provided for monitoring the resulting dc equivalent of the am-

Table 3-2 - continued

Figure 3-2 Reference	Connector	Function
		plified input signal. The output signal will drive only a high impedance external monitor.
5	TO RECORDER (J5) Connector	An isolated BNC-type* connector provided to supply analog signals to the Series 1580 Pattern Recorder.
6	TO RECORDER (J4) Connector	A dual in-line connector with locking clips designed to provide range signals and operating voltages to the Model 1587 DC Amplifier when used with the Series 1580 Pattern Recorder. The functions provided through this connector are listed below: Pin 1 - +15V Pins 2,3 - COM (±15V) Pin 4 - -15V dc Pins 5,6 - N.C. Pin 7 - Chassis Ground Pin 8 - +5V dc Pin 9 - COM (+5V) Pin 10 - N.C. Pin 11 - Range 2 } (Signals to Microprocessor Pin 12 - Range 3 } Pin 13 - Range 4 } Pin 14 - Start Update (Microprocessor Command)

*NOTE: Be aware that none of the above BNC-type connectors provide a chassis ground potential. Common chassis grounding of external monitoring equipment must be provided separately when required. Common chassis grounding is provided through connector J4 TO RECORDER when used with the Series 1580 Pattern Recorder.

3.3 OPERATING PROCEDURE

3.3.1 Operating power is provided to the Model 1587 DC Amplifier from the interconnected Series 1580 Pattern Recorder. Applying ac power to the Series 1580 Pattern Recorder simultaneously provides operating voltages to enable the Model 1587 DC Amplifier.

3.3.2 Select the desired function to be recorded on the Series 1580 Pattern Recorder by positioning the front panel INPUT FUNCTION switch accordingly. The following instructions must be used with the Operating Procedures given in the Series 1580 Pattern Recorder instruction manual to assure satisfactory results.

A. INPUT FUNCTION SWITCH POSITION: AUX SIGNAL INPUT: AUXILIARY INPUT CONNECTORS (J1 OR J2)

3.3.3 The following procedures apply to operating the Model 1587 DC Amplifier with Auxiliary Input equipment.

1. Connect the input signal to either the front panel AUXILIARY INPUT connector (J1) or the rear panel AUXILIARY INPUT connector (J2). The input signal level should not exceed 0V to +10V, 0V to -10V, or 0V to ±5.0V. These are the maximum design levels which the Model 1587 DC Amplifier will respond to.

2. If necessary, operate the front panel INPUT FUNCTION switch to AUX position.

3. Observe the front panel REVERSE INPUT POLARITY indicator. Reverse the input signal connections if the indicator is illuminated.

4. To record a linear plot of a bipolar input signal, determine the maximum signal range needed for a full scale recording pen deflection. Use the front panel LINEAR OFFSET RANGE switch and the VARIABLE ATTENUATOR control to make the pen adjustment. The front panel screwdriver adjustable LINEAR OFFSET control provides for the offset adjustment once the linear offset range has been selected. The LINEAR OFFSET RANGE switch positions provide the following control:

COARSE - A pen offset range for a 0V to ±5.0V input signal
MEDIUM - A pen offset range for a 0V to ±0.5V input signal
FINE - A pen offset range for a 0V to ±0.1V input signal

B. INPUT FUNCTION SWITCH POSITION: PHASE SIGNAL INPUT: INPUT FROM PHASE UNIT (J7) CONNECTOR

3.3.4 The following procedures apply to operating the Model 1587 DC Amplifier using phase measurement equipment. The procedures are arranged using a Scientific-Atlanta Model 1823A Digital Phase Display for an example.

1. An output signal from connector J5 on the Model 1823A Digital Phase Display is coaxially connected to the Model 1587 DC Amplifier rear panel INPUT FROM PHASE UNIT connector (J7).

2. Operate the front panel INPUT FUNCTION switch to PHASE position. The Series 1580 Pattern Recorder should be conditioned for a "LINEAR" function of the input signal.

3. The Model 1823A Digital Phase Display outputs a negative dc signal (0V to -3.6V) whose amplitude has relationship to the measured phase. For example,

0V = -180^{o}, -45^{o}, or -18^{o}
-1.8V = 0^{o}
-3.6V - $+180^{o}$, $+45^{o}$, or $+18^{o}$

These signals must be interpreted through the operator for the recorder chart paper because the recorder circuits will not automatically recognize which range is being used. The recorder chart paper is calibrated with all three ranges.

4. The Model 1587 DC Amplifier front panel LINEAR OFFSET (recessed control) should be set fully counterclockwise. Next, adjust the source (i.e., Model 1823A Digital Phase Display) for a full scale ($+180^{o}$, $+45^{o}$, or $+18^{o}$) output signal. Then adjust the Model 1587 DC Amplifier front panel VARIABLE ATTENUATOR for full scale pen deflection on the Series 1580 Pattern Recorder.

5. The equipment arrangement is now ready for normal operation.

C. INPUT FUNCTION SWITCH POSITIONS: A LIN; B LIN; A LOG; B LOG; A/B; AB - SIGNAL INPUT: INPUT FROM RATIOMETER (J6) CONNECTOR

3.3.5 The following procedures apply to operating the Model 1587 DC Amplifier using amplitude or other ratio measurement equipment. The procedures are arranged using a Scientific-Atlanta Series 1830 Digital Amplitude Display for an example.

1. Output signals from connector J13 on the Series 1830 Digital Amplitude Display unit are cable connected to the Model 1587 DC Amplifier rear panel INPUT FROM RATIOMETER connector (J6).

2. The front panel INPUT FUNCTION switch must be positioned to the desired function. Condition the Series 1580 Pattern Recorder for LINEAR response.

3. The operator should be knowledgeable of the signal input qualifications. For example, the Series 1830 Digital Amplitude Display two channel unit can output the following signals:

A LIN; B LIN = 0V to +1.2V - 0% to 100%
A LOG; B LOG = 0V to +4.0V = 0 dB to -80 dB
AB = 0V to +4.0V = 0 dB to -80 dB
A/B = 0V to +4.0V = 0 dB to -80 dB

3.3.6 A LIN, B LIN Operation. The following procedures are an example of operation with the Model 1587 DC Amplifier front panel INPUT FUNCTION switch set to either A LIN or B LIN position.

1. Position the Model 1587 DC Amplifier front panel INPUT FUNCTION switch to either A LIN or B LIN position. Set linear offset fully CCW.

2. Condition the Series 1580 Pattern Recorder PEN FUNCTION switch for LIN operation and the OFFSET dB switch to the 20 dB position.

3. Condition the Series 1830 Digital Amplitude Display controls for 100% of display reading.

4. Adjust the Model 1587 DC Amplifier front panel VARIABLE ATTENUATOR to align the recorder pen at the 100% chart paper line.

5. Resume normal operation. The Series 1580 Pattern Recorder pen will follow the linear response of the Series 1830 Digital Amplitude Display output signal of either Channel A or Channel B, as selected.

3.3.7 A LOG, B LOG Operation. The following procedures are an example of operation with the Model 1587 DC Amplifier front panel INPUT FUNCTION switch set to either A LOG or B LOG position.

1. Position the Model 1587 DC Amplifier front panel INPUT FUNCTION switch to either A LOG or B LOG position.

2. Condition the Series 1580 Pattern Recorder PEN FUNCTION for LIN operation and the OFFSET dB switch to the 0 dB position.

3. Condition the Series 1830 Digital Amplitude Display controls for 0 dB of display reading.

4. Position the Model 1587 DC Amplifier front panel LINEAR OFFSET RANGE switch to COARSE and adjust the LINEAR OFFSET control (screwdriver adjustable) to align the recording pen on the 0 dB chart line.

5. Decrease the input signal being applied to the Series 1830 Digital Amplitude Display by 40 dB and observe the digital display indicates -40 dB.

6. Adjust the Model 1587 DC Amplifier front panel VARIABLE ATTENUATOR control to align the recorder pen on the 40 dB chart line (midscale).

7. Repeat Steps 3 through 6, inclusive, as necessary to achieve exact calibration of the recorder pen system.

8. Resume normal operation. The Series 1580 Pattern Recorder pen will follow the response of the Series 1830 Digital Amplitude Display output signal as a LOG function of either Channel A or Channel B.

3.3.8 A/B Operation.* The following procedures are an example of operation with the Model 1587 DC Amplifier front panel INPUT FUNCTION switch set to the A/B position.

1. Position the Model 1587 DC Amplifier front panel INPUT FUNCTION switch to the A/B position.

2. Operate the Series 1580 Pattern Recorder front panel PEN FUNCTION switch to LIN and the OFFSET dB switch to 0 dB position.

3. Adjust the Model 1833A Ratiometer display front panel controls to obtain a 0 dB indication on both displays (Channel A and Channel B).

4. Operate the Model 1587 DC Amplifier front panel LINEAR OFFSET RANGE switch to the COARSE position and adjust the LINEAR OFFSET control (screwdriver adjustable) to align the recording pen on the 0 dB chart line.

5. Decrease the Channel A input to the Model 1833A Ratiometer display by 40 dB.

6. Observe that the Channel A display of the Model 1833A Ratiometer display indicates -40 dB and operate the Model 1587 DC Amplifier front panel VARIABLE ATTENUATOR to align the recording pen to the 40 dB chart line (midscale).

7. Repeat Steps 3 through 6, inclusive, as necessary to achieve exact calibration of the recorder pen system.

8. The recorder pen will now follow the Model 1833A Ratiometer display output signals as the ratio A/B changes.

3.3.9 AB Operation.* The following procedures are an example of operation with the Model 1587 DC Amplifier front panel switch set to the AB position.

1. If necessary, position the Model 1587 DC Amplifier front panel INPUT FUNCTION switch to the AB position.

2. Operate the Series 1580 Pattern Recorder front panel PEN FUNCTION switch to LIN and the OFFSET dB switch to 0 dB position.

3. Adjust the Model 1833A Ratiometer display front panel controls to obtain a 0 dB indication on both displays (Channel A and Channel B).

4. Operate the Model 1587 DC Amplifier front panel LINEAR OFFSET RANGE switch to the COARSE position and adjust the LINEAR OFFSET control (screwdriver adjustable) to align the recording pen on the 0 dB chart line.

5. Decrease the Channel A input to the Model 1833A Ratiometer display by 40 dB.

6. Observe that the Channel A display of the Model 1833A Ratiometer display indicates -40 dB and operate the Model 1587 DC Amplifier front panel VARIABLE ATTENUATOR to align the recording pen to the 40 dB chart line (midscale).

7. Repeat Steps 3 through 6, inclusive, as necessary to achieve exact calibration of the recorder pen system.

8. The recorder pen will now follow the Model 1833A Ratiometer display output signals as the product AB changes.

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*Note that the circuit design of the Model 1587 DC Amplifier presumes that a Channel B input signal is always the reference and for the maximum value of Channel A, that A = B. Therefore, A/B = 0 dB and AB = 0 dB. There must be a dual channel unit input in order to plot A/B and AB.

CHAPTER 4
THEORY OF OPERATION

4.1 GENERAL

4.1.1 The Model 1587 DC Amplifier is a dc preamplifier designed to compliment and extend the capabilities of the Series 1580 Pattern Recorder. It will accept dc signals generated by phase measuring equipment such as the Scientific-Atlanta Model 1823A Digital Phase Display. The Model 1587 DC Amplifier also accepts dc signals representing a ratio and/or proportion as measured against a standard or reference. These signals are generated by equipment such as a Series 1830 Digital Amplitude Display.

4.1.2 Auxiliary signal input connectors are also provided. Signals input can be unipolar or bipolar with offsets up to 100 volts. The Series 1580 Pattern Recorder will respond to either signal input format not exceeding the values listed in Table 1-1, Technical Specifications.

4.1.3 Operating voltages are provided to the Model 1587 DC Amplifier from the Series 1580 Pattern Recorder power supply through a multi-wire cable assembly. Amplified output signals are returned through a separate coaxial cable assembly to the Series 1580 Pattern Recorder for further processing.

4.2 MODEL 1587 DC AMPLIFIER

4.2.1 A block diagram of the Model 1587 DC Amplifier is shown in Figure 4-1. All input dc signals are routed through

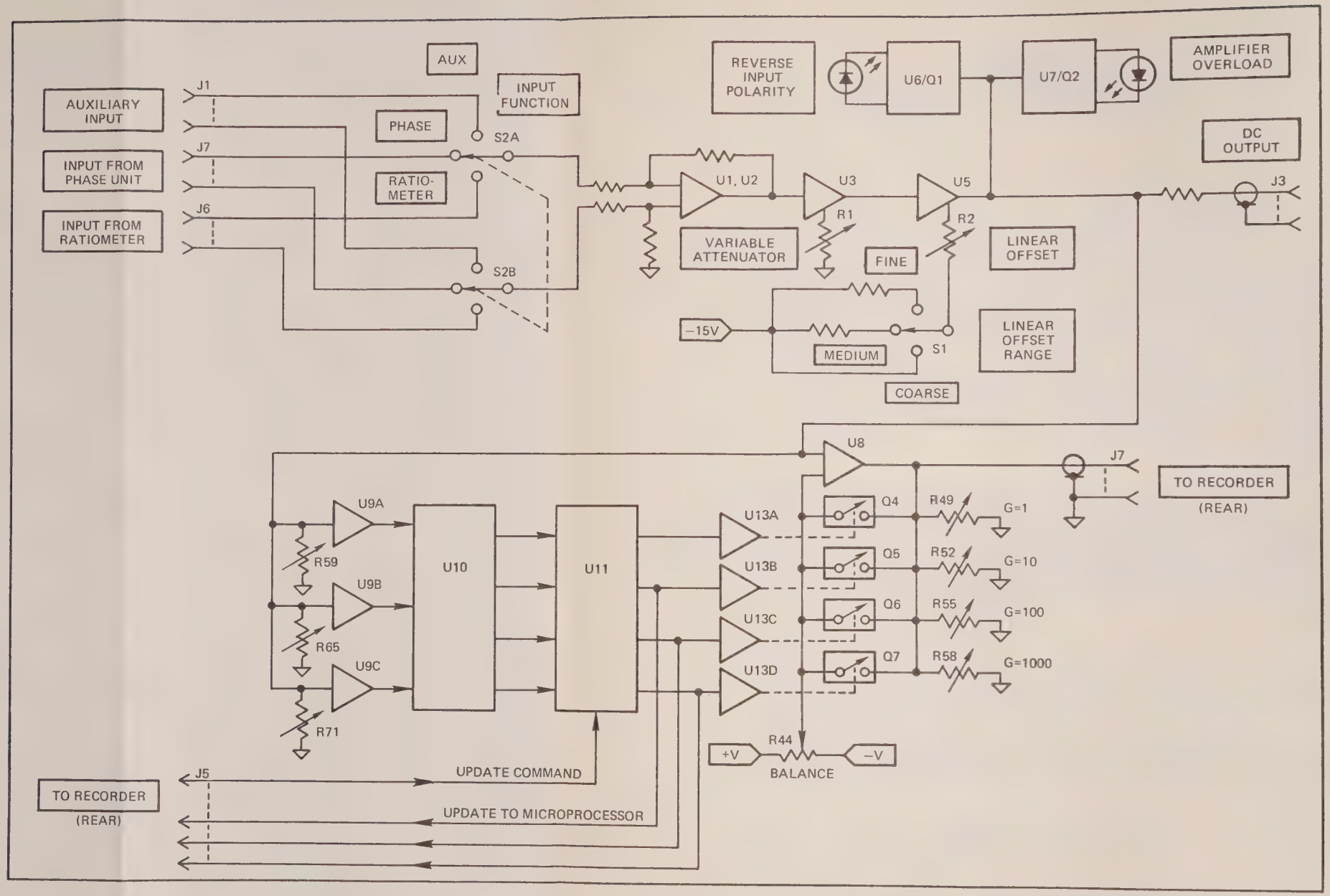

Figure 4-1. Model 1587 DC Amplifier (DCA), Block Diagram

the front panel INPUT FUNCTION switch (S2) to the differential amplifier U1. This component is a precision, very stable, low noise dc amplifier having a gain of 0.1. Amplifier U2 functions as a follower to allow a guarded input for U1 connected in the differential mode.

4.2.2 Output signals from amplifier U2 are applied to variable gain amplifier U3. The gain of this stage is controlled by the 10-turn front panel VARIABLE ATTENUATOR control (R1).

4.2.3 Amplified output signals from U3 are applied to the unity gain circuit using amplifier U5. The circuit components are arranged to sum the input signal with provisions for offsetting the signal as necessary to permit the plotting of bipolar input signals. Signal offsetting is controlled by the components selected by the three position front panel LINEAR OFFSET RANGE switch (S1) to provide an approximate voltage range for amplifier U5 operation. The front panel LINEAR OFFSET control (screwdriver adjustable, R2) provides the precision tuning of the voltage range through amplifier U5. The output of amplifier U5 must always be positive for proper pen deflection of the Series 1580 Pattern Recorder.

4.2.4 The front panel REVERSE INPUT POLARITY indicator is driven by a comparator circuit using components U6 and Q1. This comparator circuit detects whether the output of amplifier Q5 is positive or negative. If the signal is negative, the LED indicator becomes illuminated.

4.2.5 The front panel AMPLIFIER OVERLOAD indicator is driven by a comparator circuit using components U7 and Q2. This comparator circuit detects the output of amplifier Q5 and is triggered when the signal level becomes +10.5 volts. When the circuit is triggered, the LED indicator becomes illuminated to alert the operator of a signal level greater than the Series

approved, nonabrasive (window-type) solvents. Only after field repair should flux-removing solvents be used on the printed circuit board and only if deemed necessary.

5.2.2 No regular lubrication is required for the Model 1587 DC Amplifier; however, if the unit is rack-mounted on slides, the slide mechanism may need periodic lubrication.

5.3 TROUBLESHOOTING

5.3.1 In the event that faulty operation is experienced with a Model 1587 DC Amplifier, a thorough visual inspection of all interconnecting cables, the cable connectors, front and rear panel components, and the printed circuit board components should be completed first. Then, with knowledge of the system operation (as provided in Chapter 4), a logical deduction should limit the area of malfunction to a specific replacement or repairable item. When a malfunction is elusive by occuring only periodically or without logical cause, then test equipment and diagnostic troubleshooting must be used.

A. TEST EQUIPMENT

5.3.2 To maintain and repair the Model 1587 DC Amplifier using diagnostic troubleshooting, the following test equipment (or equivalents) will be required:

EQUIPMENT	MANUFACTURER	MODEL
Digital Voltmeter	Fluke	8800A
Dual Trace Oscilloscope	Tektronix	454
Audio Step Attenuator	General Radio	1450-TA

Power Supply capable of providing the following sources:

+15.0 volts dc at 100 mA with ≤15 mV peak-to-peak ac ripple
-15.0 volts dc at 100 mA with ≤15 mV peak-to-peak ac ripple
+5.0 volts dc at 20 mA with ≤10 mV peak-to-peak ac ripple
Separate common returns for the ±15 volt and the +5 volt dc sources.

B. GENERAL TROUBLESHOOTING

5.3.3 There should be two levels of general troubleshooting. The first level is to determine that a suspect malfunction is IN the Model 1587 DC Amplifier and NOT in the peripheral equipment or interconnecting cables. When the suspect malfunction is determined to be in the Model 1587 DC Amplifier, the second level of general troubleshooting is to isolate in which area of the circuitry a failure or malfunction has occurred, and finally isolate the faulty component for repair or replacement.

5.4 BENCH TESTING

5.4.1 The Model 1587 DC Amplifier can be operated on a test bench as an independent unit for a time necessary to troubleshoot for a possible malfunction. A block diagram illustrating a general bench test arrangement is shown in Figure 5-1. It is suggested that external power supply sources be applied

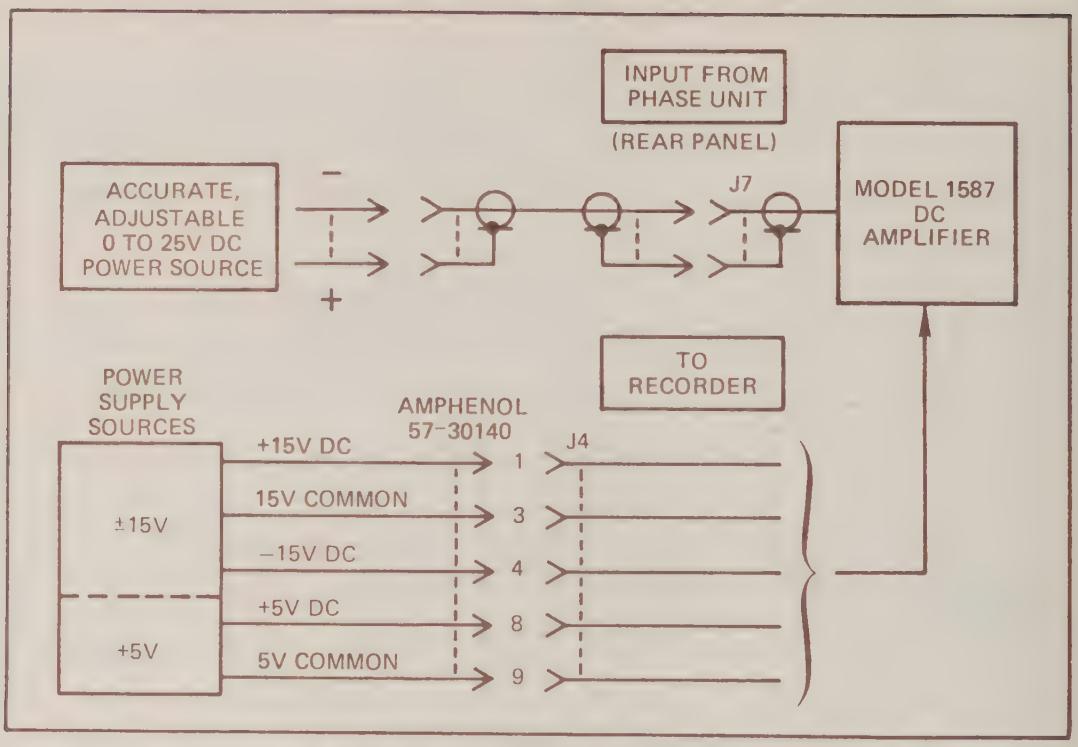

Figure 5-1. Model 1587 DC Amplifier, Simplified Bench Test Arrangement, Block Diagram

to the Model 1587 DC Amplifier through a mating connector to the rear panel J5 (using an Amphenol 57-30140, or equivalent) for convenience.

5.4.2 A very simple block diagram of the Model 1587 DC Amplifier is shown in Figure 5-2. Circuit components are grouped with their relative function and associated test points for convenience of following the test procedures. The test procedures presume (1) that the technician is qualified and experienced with similar equipment; (2) that proper operating voltages are applied as shown in Figure 5-1; and (3) test equipments to be used are within their prescribed recalibration cycles. Figure 5-3 identifies the Model 1587 DC Amplifier component and test point locations on the printed circuit board assembly.

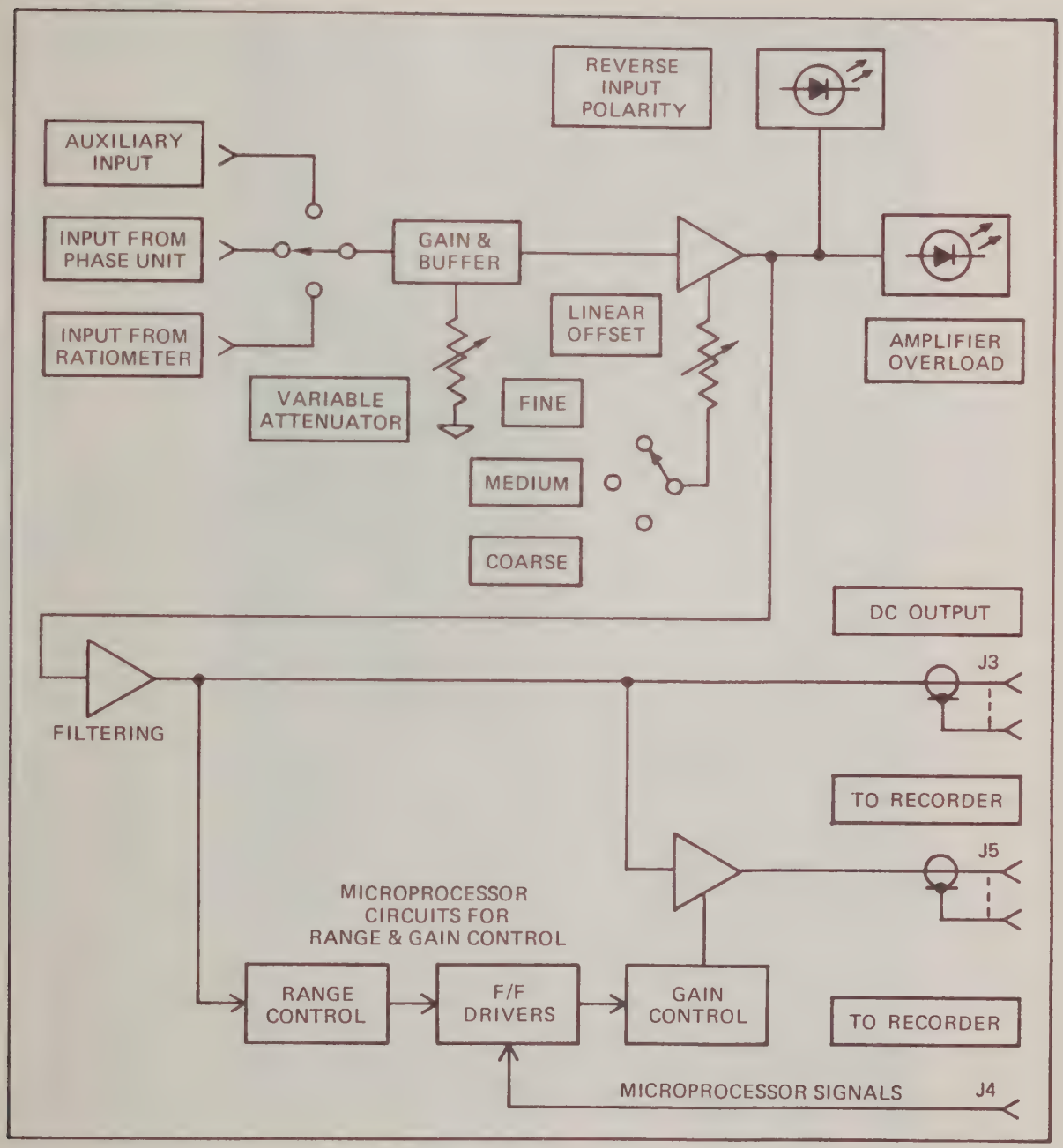

Figure 5-2. Model 1587 DC Amplifier, Simplified Block Diagram

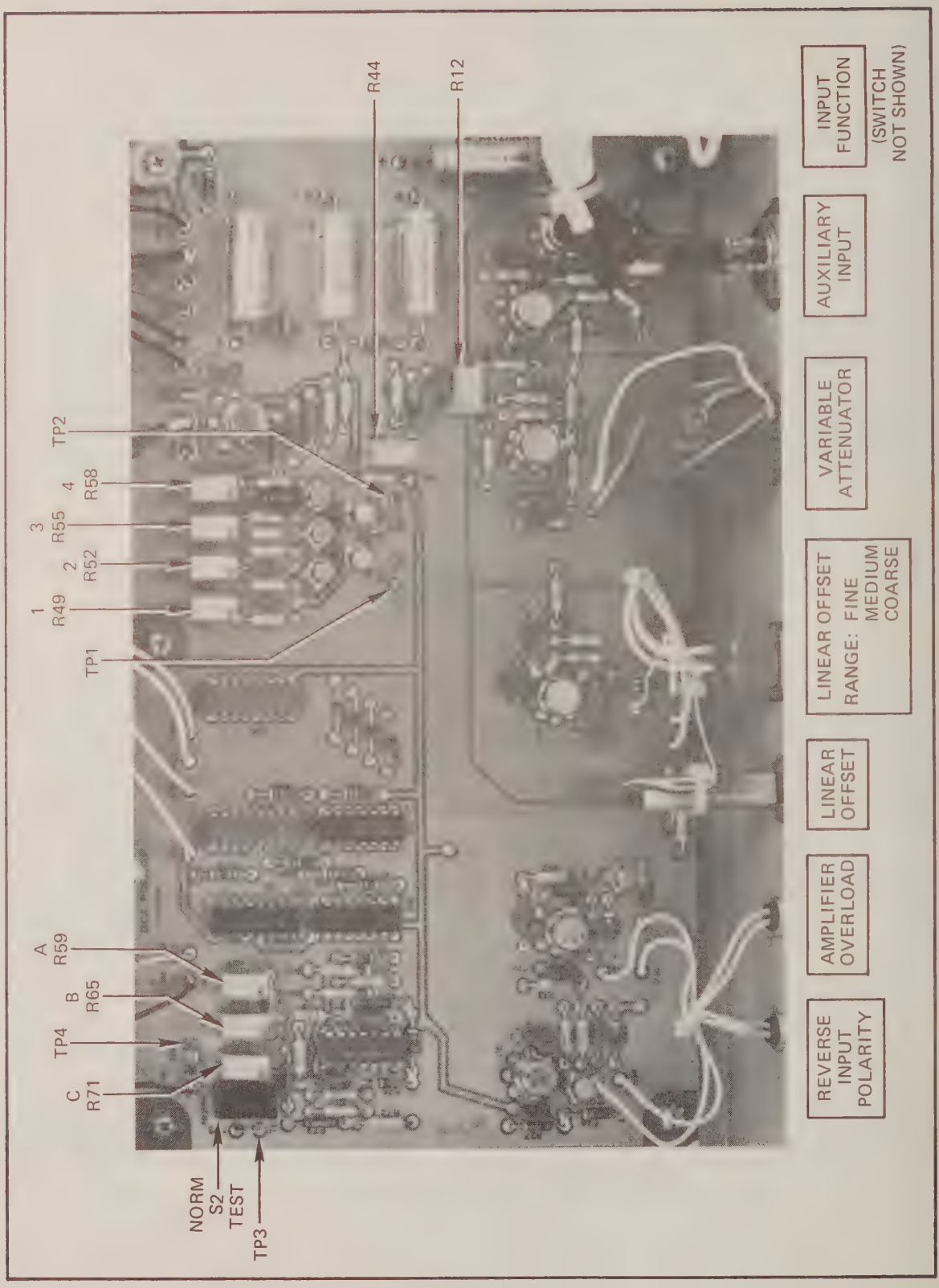

Figure 5-2. Model 1587 DC Amplifier, Printed Circuit Board Assembly, Location of Components and Test Points Used for Maintenance

A. AMPLIFIER (U3) BALANCE

5.4.3 Test the Model 1587 DC Amplifier U3 circuit balance as follows:

a. Condition the Model 1587 DC Amplifier for bench testing as suggested in Figure 5-1.

b. Operate the front panel controls as follows:

Input FUNCTION switch to PHASE position
VARIABLE ATTENUATOR to full clockwise position
LINEAR OFFSET to full counterclockwise position

c. Short circuit the rear panel INPUT FROM PHASE UNIT connector (J7).

NOTE

Remember this connector is isolated from chassis ground. A proper short circuit is from the outer shell to the center conductor.

d. Connect the digital voltmeter to the rear panel DC OUTPUT connector (J3). The digital voltmeter should indicate 0.000 (±0.005) volt dc. If necessary, adjust the variable resistor R12 until the requirement is met. When the requirement is met, proceed to the next desired test.

B. LINEAR OFFSET RANGE TEST

5.4.4 Test the operation of the Model 1587 DC Amplifier front panel LINEAR OFFSET RANGE switch and LINEAR OFFSET control as follows:

a. Condition the Model 1587 DC Amplifier for bench testing as suggested in Figure 5-1.

b. Short circuit the rear panel INPUT FROM PHASE UNIT connector (J7).

NOTE

Remember this connector is isolated from chassis ground. A proper short circuit is from the outer shell to bhe center conductor.

c. Connect the digital voltmeter to the rear panel DC OUTPUT connector (J3). Operate the front panel INPUT FUNCTION switch to the PHASE position.

d. Operate the front panel VARIABLE ATTENUATOR control to full counterclockwise position. Adjust the LINEAR OFFSET control with a small screwdriver to full clockwise and counterclockwise rotation for each position of the LINEAR OFFSET RANGE switch. Observe the digital voltmeter indication as listed below:

LINEAR OFFSET RANGE Switch Position	LINEAR OFFSET Control	Digital Voltmeter Indication
COARSE	CCW	0.000 (±0.005) volt dc
COARSE	CW	≥6.0 volts dc
MEDIUM	CCW	0.000 (±0.005) volt dc
MEDIUM	CW	≥0.6 volt dc
FINE	CCW	0.000 (±0.005) volt dc
FINE	CW	≥0.06 volt dc

e. If the measured Linear Offset Range Test requirements are satisfactory, proceed to the next desired test.

C. MAXIMUM SENSITIVITY MEASUREMENT

5.4.5 Test the Model 1587 DC Amplifier for maximum sensitivity using the following procedures:

a. Condition the Model 1587 DC Amplifier for bench testing as suggested in Figure 5-1.

b. Connect the digital voltmeter to the rear panel DC OUTPUT connector (J3). Operate the front panel INPUT FUNCTION switch to the PHASE position and the VARIABLE ATTENUATION control fully clockwise. Use a small screwdriver and operate the LINEAR OFFSET control fully counterclockwise.

c. Connect an accurate, adjustable dc voltage source to the INPUT FROM PHASE UNIT connector (J7). OBSERVE THE CORRECT POLARITY. Negative to the center conductor and positive to the connector shell. Measure, and adjust if necessary, that the input voltage level is -3.55 volts dc.

d. Observe the indication on the digital voltmeter connected to the rear panel DC OUTPUT connector (J3). The normal indication should be $\geq$7.90 volts dc.

e. If the measurement indication is satisfactory, proceed to the Attenuator Range Test, or other desired test, as necessary.

D. ATTENUATOR RANGE TEST

5.4.6 Test the Model 1587 DC Amplifier Attenuator Range using the following procedure. If this test is performed immediately after "C. MAXIMUM SENSITIVITY MEASUREMENT", start at Step d.

a. Condition the Model 1587 DC Amplifier for bench testing as suggested in Figure 5-1.

b. Connect the digital voltmeter to the rear panel DC OUTPUT connector (J3). Operate the front panel INPUT FUNCTION switch to the PHASE position and the VARIABLE ATTENUATION control fully clockwise. Use a small screwdriver and operate the LINEAR OFFSET control fully counterclockwise.

c. Connect an accurate, adjustable dc voltage source to the INPUT FROM PHASE UNIT connector (J7). OBSERVE THE CORRECT POLARITY. Negative to the center conductor and positive to the connector shell. Measure, and adjust if necessary, that the input voltage level is -3.55 volts dc.

d. Observe the indication on the digital voltmeter connected to the rear panel DC OUTPUT connector (J3). The normal indication should be $\geq$7.90 volts dc. Make a note of the displayed indication.

e. Rotate the front panel VARIABLE ATTENUATION control to full counterclockwise position. The digital voltmeter display should be at least 1/10 of the reading noted in Step d. (For example, if the indication in Step d was 7.90 volts dc, the indication for Step e should be 0.790 volt dc or less.)

f. If the measurement indication is satisfactory, proceed to the next desired test.

E. AMPLIFIER OVERLOAD TEST

5.4.7 Test the Model 1587 DC Amplifier capability to react to a signal input overload condition as follows:

a. Condition the Model 1587 DC Amplifier for bench testing as suggested in Figure 5-1.

b. Connect the digital voltmeter to the rear panel DC OUTPUT connector (J3). Operate the front panel INPUT FUNCTION switch to the PHASE position and the VARIABLE ATTENUATION control fully counterclockwise.

c. Connect an accurate, adjustable dc voltage source to the INPUT FROM PHASE UNIT connector (J7). OBSERVE THE CORRECT POLARITY. Negative to the center conductor and positive to the connector shell. Measure, and adjust if necessary, that the input voltage level is -11.0 volts dc.

d. Slowly turn the VARIABLE ATTENUATION control clockwise while observing both the digital voltmeter and the front panel AMPLIFIER OVERLOAD indicator.

e. Observe the digital voltmeter indication at the moment the AMPLIFIER OVERLOAD indicator illuminates. Normal digital voltmeter indication should be between +10.3 and +10.7 volts dc.

f. If the measurement indication is satisfactory, proceed to the Amplifier Polarity Test, or other desired test, as necessary.

F. AMPLIFIER POLARITY TEST

5.4.8 Test the Model 1587 DC Amplifier for proper input signal polarity recognition using the following procedures. If this test is performed immediately after "E. AMPLIFIER OVERLOAD TEST", start at Step d.

a. Condition the Model 1587 DC Amplifier for bench testing as suggested in Figure 5-1.

b. Connect the digital voltmeter to the rear panel DC OUTPUT connector (J3). Operate the front panel INPUT FUNCTION switch to the PHASE position.

c. Connect an accurate, adjustable dc voltage source to the INPUT FROM PHASE UNIT connector (J7). OBSERVE THE CORRECT POLARITY. Negative to the center conductor and positive to the connector shell. Measure, and adjust if necessary, that the input voltage level is approximately -5.0 volts dc.

d. Adjust the front panel VARIABLE ATTENUATOR control until the digital voltmeter indicates a level of +1.00 volt dc output.

e. Reverse polarity of the dc input signal to INPUT FROM PHASE UNIT connector (J7). Observe that the digital voltmeter now indicates -1.00 volt dc output and that the front panel REVERSE INPUT POLARITY indicator is illuminated.

f. If the measurement indications are satisfactory, proceed to the next desired test.

G. COMPARATOR ADJUSTMENT

5.4.9 Test, and adjust if necessary, the Model 1587 DC Amplifier comparator circuits using the following procedures:

a. Condition the Model 1587 DC Amplifier for bench testing as suggested in Figure 5-1.

b. Connect the digital voltmeter to the rear panel DC OUTPUT connector (J3). Operate the front panel INPUT FUNCTION switch to the PHASE position.

c. Connect an accurate, adjustable dc voltage source through a Step Attenuator set to 0 dB insertion loss to the INPUT FROM PHASE UNIT connector (J7). OBSERVE THE CORRECT POLARITY. Negative to the center conductor and positive to the connector shell. Measure, and adjust if necessary, that the input voltage level is -10.0 volts dc.

d. Connect the Tektronix 454 oscilloscope Channel A input to U9, pin 1 and test point TP4 (common). Test points and components are identified in Figure 5-3. Adjust the oscilloscope controls to readily identify both 0 volt and +5 volts dc indications.

e. Adjust the Step Attenuator to add 2.0 dB. (The input signal level is now 2.0 dB below -10 volts dc.) Adjust the front panel VARIABLE ATTENUATOR control until the digital voltmeter indicates +7.943 volts dc.

1. "A" Circuit. Add 20 dB to the input signal using the Step Attenuator (Input signal level now at 22 dB below -10 volts dc).

Requirement:

The oscilloscope display should change from +5 volts to 0 volt. If necessary, adjust variable resistor R59 to obtain a 0 volt display at -22 dB and a +5 volt display at -20 dB. (The comparator changes levels when input signal changes by 2 dB.)

2. "B" Circuit. Using the test arrangement to complete the "A" circuit test, move the oscilloscope Channel A input to U9, pin 2 and test point TP4 (common). Add an additional 20 dB to the signal input using the Step Attenuator (signal level now at -42 dB below -10 volts dc).

Requirement:

The oscilloscope display should change from +5 volts to 0 volt. If necessary, adjust variable resistor R65 to obtain a 0 volt display at -42 dB and a +5 volt display at -40 dB.

3. "C" Circuit. Using the test arrangement to complete the "B" circuit test, move the oscilloscope Channel A input to U9, pin 14 and test point TP4 (common). Add an additional 20 dB to the signal input using the Step Attenuator (signal level now at -62 dB below -10 volts dc).

Requirement:

The oscilloscope display should change from +5 volts to 0 volt. If necessary, adjust variable resistor R71 to obtain a 0 volt display at -62 dB and a +5 volt display at -60 dB.

f. When the measured Comparator Adjustment Tests are satisfactory, proceed to the next desired test.

H. OUTPUT AMPLIFIER BALANCE

5.4.10 Test, and adjust is necessary, the Model 1587 DC Amplifier output amplifier balance using the following procedures:

a. Condition the Model 1587 DC Amplifier for bench testing as suggested in Figure 5-1. A better test arrangement is to use a Series 1580 Pattern Recorder to supply operating voltages and terminate the rear panel TO RECORDER connector (J5) through a BNC TEE connector.

b. Short circuit the rear panel INPUT FROM PHASE UNIT connector (J7). Position the front panel FUNCTION switch to PHASE.

NOTE

Remember this connector is isolated from chassis ground. A proper short circuit is from the outer shell to the center conductor.

c. Operate the front panel VARIABLE ATTENUATOR control fully counterclockwise.

d. Connect the digital voltmeter to the rear panel TO RECORDER connector (J5) through the BNC TEE connector.

e. Observe the digital voltmeter for a 0.000 (±0.020) volt dc indication. If necessary, adjust variable resistor R44 to obtain this indication.

f. When the output amplifier balance test measures satisfactory, proceed to the next desired test.

I. AMPLIFIER GAIN AND SWITCHING ADJUSTMENT

5.4.11 Test, and adjust if necessary, the Model 1587 DC Amplifier gain and switching circuits using the following procedures:

a. Condition the Model 1587 DC Amplifier for bench testing as suggested in Figure 5-1.

b. Connect the digital voltmeter to the rear panel DC OUTPUT connector (J3). Operate the front panel INPUT FUNCTION switch to the PHASE position.

c. Connect an accurate, adjustable dc voltage source through a Step Attenuator set for 0 dB insertion loss to the INPUT FROM PHASE UNIT connector (J7). OBSERVE THE CORRECT POLARITY. Negative to the center conductor and positive to the connector shell. Measure, and adjust if necessary, that the input voltage level is -10.0 volts dc.

d. Adjust the Step Attenuator to add 2.0 dB. (The input signal is now 2.0 dB below -10 volts dc.) Adjust the front panel VARIABLE ATTENUATOR control until the digital voltmeter indicates +7.943 volts dc.

e. Move the digital voltmeter connection from the DC OUTPUT connector (J3) to the TO RECORDER connector (J5). Connect the digital voltmeter through a BNC TEE connector if a Series 1580 Pattern Recorder is providing the circuit load through the TO RECORDER connector (J5).

f. Using the Step Attenuator and a jumper connection between terminal E27 and test point TP4, test for the following requirements.

NOTE

The jumper connection between terminal E27 and TP4 should be removed and reconnected for each change in step attenuator settings. This is necessary to allow the circuits of component U10 to clock to the new output.

Requirements:

STEP ATTENUATOR SETTING	DIGITAL VOLTMETER INDICATION	IF NECESSARY, ADJUST
-2 dB	7.94 volts	R49 (1)
-22 dB	7.94(±0.05) volts	R52 (2)
-42 dB	7.94(±0.05) volts	R55 (3)
-62 dB	7.94(±0.05) volts	R58 (4)
-82 dB	0.794(±0.1) volts	None

5.4.12 This completes the maintenance testing of the Model 1587 DC Amplifier. Typical output signals have been provided for all circuits with variable controls operating under normal conditions. Failure to obtain the specified output signals identifies a circuit malfunction requiring further trouble-

shooting to locate and repair the cause. When returning the Model 1587 DC Amplifier to normal service, be sure all cover plates are in place and secured tightly.

5.5 REGIONAL SERVICE CENTERS

5.5.1 Regional Service Centers capable of performing periodic maintenance and providing assistance associated with the Model 1587 DC Amplifier and other Scientific-Atlanta equipment are listed below. Service assistance for areas not listed can be provided through Scientific-Atlanta Service Department. For further information, contact Mr. Jim Cox, 3845 Pleasantdale Road, Atlanta, Georgia 30340, TEL: 404-449-2000, TWX: 810-766-4912, TELEX: 0542898.

NORTH AMERICAN SERVICE CENTERS

Southeastern Regional Service Center
3845 Pleasantdale Road
Atlanta, Georgia 30340
Tel: 404-449-2000

Washington D.C. Regional Service Center
Priest Bridge Business Part
2121 Baldwin Avenue, Suite 25A
Crofton, Maryland 21114
Tel: 301-261-3233

New England Regional Service Center
87 Terrace Hall Avenue
Burlington, Massachusetts 91803
Tel: 617-272-1256

Southwestern Regional Service Center
Suite 1131, Frito-Lay Tower
Dallas, Texas 75235
Tel: 214-357-4558

So. California Regional Service Center
10039 South Pioneer Blvd.
P.O. Box 2668
Santa Fe Springs, California 90670
Tel: 213-449-9411

EUROPEAN SERVICE CENTERS

Scientific-Atlanta (U.K.), Ltd.
1-7 Sunbury Cross Centre
Staines Road West
Sunbury on Thames
Middlesex, TW16 7BB, England
Tel: Sunbury on Thames 89751

Scientific-Atlanta (FRANCE) SARL
Centre d'Affaires Paris-Nord
Batiment Ampere No. 5
93153 Le Blanc-Mesnil, France
Tel: 931-6820, Paris

CHAPTER 6
PARTS LISTS

6.1 GENERAL

6.1.1 The parts lists for the Model 1587 DC Amplifier are included in this chapter. Special modifications, if any, are enclosed in the envelope in the rear of this manual.

6.2 EXPLANATION OF COLUMN HEADINGS

6.2.1 REF. DESIG. This identifies the assigned reference designation applicable to a system or equipment sub-unit having a separate prefix and arrangement of individual components.

6.2.2 COMP. DESIG. This identifies the components of the sub-unit in alpha-numerical order.

6.2.3 SCIENTIFIC-ATLANTA (S-A) PART NO. A five or six digit number assigned by the manufacturer to the specific part for identification and correct replacement ordering information.

6.2.4 DESCRIPTION. A brief electrical and/or mechanical description of the component.

6.2.5 FSCM. The proper Federal Supply Code for manufacturers are entered in this column. The code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) in effect as of the publication date of this manual. Alphabetical codes have been

arbitrarily assigned to suppliers not assigned in the H4 handbooks and these identifying codes are cross-referenced (code to name) at the end of this section.

6.2.6 MFR. PART NO. The number assigned to a part by an outside supplying manufacturer is listed in this column.

6.3 ORDERING PARTS

6.3.1 When ordering parts from Scientific-Atlanta, always include the Scientific-Atlanta part number, the part description, the unit name, the unit serial number, the subassembly name, the part manufacturer (FSCM), and the manufacturer's part number.

6.4 PARTS SUBSTITUTION

6.4.1 Common components may differ from those identified in the parts list. This difference is due to the substitution of a more current part during assembly. When this occurs, the replacement may be either a part identical to the type removed or a part meeting the description given in the parts list.

MODEL 1587 DCA ASSY

REF DESIG PREFIX A01

COMP DESIG	S-A PART NO	DESCRIPTION	FSCM	MFR PART NO
A02	163053	PWB ASSY DCA MODEL 1587		
CR01	81882	LAMP LED RED .190 DIA .240 LNG 1.7V 20MA	31718	FLV110
CR02	81882	LAMP LED RED .190 DIA .240 LNG 1.7V 20MA	31718	FLV110
J 01	87058	CONN RND 3-COND MALE CHASSIS AUDIO		80-869
J02	87058	CONN RND 3-COND MALE CHASSIS AUDIO		80-869
J03	84710	CONN COAX BNC FEM TO CUP ISOLATED MT	02660	31-010
J04	70823	CONN RECT 14-COND FEM CHASSIS MT W/LOCK	02660	57 40140
J05	84710	CONN COAX BNC FEM TO CUP ISOLATED MT	02660	31-010
J06	70823	CONN RECT 14-COND FEM CHASSIS MT W/LOCK	02660	57 40140
J07	84710	CONN COAX BNC FEM TO CUP ISOLATED MT	02660	31-010
R01	74575	RESISTOR 33 OHM 2W 10% COMP	01121	RCR42G330KS
R02	87959	POT 5K OHM 1W CER RECT 1.25 LONG 22T		
S01	87251	SWITCH LEVER SP3T GRN LEVER BLK BEZEL		7211-J61-Z-Q-6-2
S02	79107	SWITCH ROT 2P 2-12 POS NSH 2 SEC	71590	PSA-205
W01	158478	CABLE ASSY INTERCONNECTING POWER		
W02	163033	CABLE ASSY INTERCONNECTING COAX		
XJ1	87059	CONN RND 3-COND FEMALE CABLE AUDIO	02660	80-868
XJ2	87059	CONN RND 3-COND FEMALE CABLE AUDIO	02660	80-868

MODEL 1587 DCA PWB ASSY

REF DESIG PREFIX A02

COMP DESIG	S-A PART NO	DESCRIPTION	FSCM	MFR PART NO
CR01		NOT ASSIGNED		
CR02		NOT ASSIGNED		
CR03	71142	DIODE 1N4154 SIL 25V 150MA	80368	1N4154
CR04	71142	DIODE 1N4154 SIL 25V 150MA	80368	1N4154
CR05	71142	DIODE 1N4154 SIL 25V 150MA	80368	1N4154
CR06	71142	DIODE 1N4154 SIL 25V 150MA	80368	1N4154
C01	80139	CAPACITR .1 MF 50V CER MONO	72982	8131-050-651-104Z
C02	75417	CAPACITR .01 MF 150V CER DISC	71590	DDM-103
C03	80139	CAPACITR .1 MF 50V CER MONO	72982	8131-050-651-104Z
C04	80139	CAPACITR .1 MF 50V CER MONO	72982	8131-050-651-104Z
C05	75417	CAPACITR .01 MF 150V CER DISC	71590	DDM-103
C06	80139	CAPACITR .1 MF 50V CER MONO	72982	8131-050-651-104Z
C07	81101	CAPACITR 1 MF 50V CER MONO 20%	72982	8131-050-651-105M
C08		NOT ASSIGNED		
C09		NOT ASSIGNED		
C10		NOT ASSIGNED		
C11		NOT ASSIGNED		
C12	80139	CAPACITR .1 MF 50V CER MONO	72982	8131-050-651-104Z
C13	75417	CAPACITR .01 MF 150V CER DISC	71590	DDM-103
C14	80139	CAPACITR .1 MF 50V CER MONO	72982	8131-050-651-104Z
C15	81101	CAPACITR 1 MF 50V CER MONO 20%	72982	8131-050-651-105M
C16	80139	CAPACITR .1 MF 50V CER MONO	72982	8131-050-651-104Z
C17	80139	CAPACITR .1 MF 50V CER MONO	72982	8131-050-651-104Z
C18	80139	CAPACITR .1 MF 50V CER MONO	72982	8131-050-651-104Z
C19	80139	CAPACITR .1 MF 50V CER MONO	72982	8131-050-651-104Z
C20	80139	CAPACITR .1 MF 50V CER MONO	72982	8131-050-651-104Z
C21	70671	CAPACITR 100 MF 25V	80183	500D107G025DD7
C22	70671	CAPACITR 100 MF 25V	80183	500D107G025DD7
C23	80139	CAPACITR .1 MF 50V CER MONO	72982	8131-050-651-104Z
C24	80139	CAPACITR .1 MF 50V CER MONO	72982	8131-050-651-104Z
C25	70671	CAPACITR 100 MF 25V	80183	500D107G025DD7
C26	70671	CAPACITR 100 MF 25V	80183	500D107G025DD7
C27	80139	CAPACITR .1 MF 50V CER MONO	72982	8131-050-651-104Z
C28	75417	CAPACITR .01 MF 150V CER DISC	71590	DDM-103
C29	70532	CAPACITR 300 PF 500V SILVER MICA 5%	14655	CD15FD301J03
C30	84225	CAPACITR .22 MF 100V CER MONO 20%	72982	8131-100-651-224M
C31	81101	CAPACITR 1 MF 50V CER MONO 20%	72982	8131-050-651-105M
Q01	77148	TRANSSTR 2N3251 PNP SIL	04713	2N3251
Q02	77147	TRANSSTR 2N3947 NPN SIL	04713	2N3947
Q03	81544	TRANSSTR 2N4856 SIL FET N-CHNL JUNC	01295	2N4856
Q04	81544	TRANSSTR 2N4856 SIL FET N-CHNL JUNC	01295	2N4856
Q05	81544	TRANSSTR 2N4856 SIL FET N-CHNL JUNC	01295	2N4856
Q06	81544	TRANSSTR 2N4856 SIL FET N-CHNL JUNC	01295	2N4856
Q07	81544	TRANSSTR 2N4856 SIL FET N-CHNL JUNC	01295	2N4856
R01	86265	RESISTOR 1.00 MEG RN55C 1% MTL FLM		RN55C1004F
R02	78928	RESISTOR 100K OHM RN55C 1% MTL FLM		RN55C1003F
R03	78928	RESISTOR 100K OHM RN55C 1% MTL FLM		RN55C1003F
R04	78928	RESISTOR 100K OHM RN55C 1% MTL FLM		RN55C1003F
R05	78933	RESISTOR 10.0K OHM RN55C 1% MTL FLM		RN55C1002F
R06	78933	RESISTOR 10.0K OHM RN55C 1% MTL FLM		RN55C1002F
R07	83911	RESISTOR 5.62K OHM RN55C 1% MTL FLM		RN55C5621F
R08	80207	RESISTOR 44.2K OHM RN55C 1% MTL FLM		RN55C4422F
R09	79985	RESISTOR 40.2K OHM RN55C 1% MTL FLM		RN55C4022F
R10	83911	RESISTOR 5.62K OHM RN55C 1% MTL FLM		RN55C5621F
R11	78928	RESISTOR 100K OHM RN55C 1% MTL FLM		RN55C1003F
R12	84883	POT 1K OHM 1/2W CERMET 20T PC MT 3/8 SQ	73138	66WR1K
R13	78928	RESISTOR 100K OHM RN55C 1% MTL FLM		RN55C1003F
R14	86265	RESISTOR 1.00 MEG RN55C 1% MTL FLM		RN55C1004F
R15		NOT ASSIGNED		
R16	80387	RESISTOR 475K OHM RN60C 1% MTL FLM		RN60C4753F
R17		NOT ASSIGNED		
R18		NOT ASSIGNED		
R19	78933	RESISTOR 10.0K OHM RN55C 1% MTL FLM		RN55C1002F
R20		NOT ASSIGNED		
R21	83921	RESISTOR 17.8K OHM RN55C 1% MTL FLM		RN55C1782F
R22	78933	RESISTOR 10.0K OHM RN55C 1% MTL FLM		RN55C1002F
R23	78931	RESISTOR 4.99K OHM RN55C 1% MTL FLM		RN55C4991F

MODEL 1587 DCA PWB ASSY

REF DESIG PREFIX A02

COMP DESIG	S-A PART NO	DESCRIPTION	FSCM	MFR PART NO
R24	78933	RESISTOR 10.0K OHM RN55C 1% MTL FLM		RN55C1002F
R25	74702	RESISTOR 1.0K OHM 1/4W 5% COMP	01121	RCR07G102JS
R26	74710	RESISTOR 2.2K OHM 1/4W 5% COMP	01121	RCR07G222JS
R27	74727	RESISTOR 10K OHM 1/4W 5% COMP	01121	RCR07G103JS
R28	83940	RESISTOR 59.0K OHM RN55C 1% MTL FLM		RN55C5602F
R29	79118	RESISTOR 100 OHM RN55C 1% MTL FLM		RN55C1000F
R30	79118	RESISTOR 100 OHM RN55C 1% MTL FLM		RN55C1000F
R31	83916	RESISTOR 10.5K OHM RN55C 1% MTL FLM		RN55C1052F
R32	84611	RESISTOR 4.53K OHM RN55C 1% MTL FLM		RN55C4531F
R33	79725	RESISTOR 3.16K OHM RN55C 1% MTL FLM		RN55C3161F
R34	74727	RESISTOR 10K OHM 1/4W 5% COMP	01121	RCR07G103JS
R35	74710	RESISTOR 2.2K OHM 1/4W 5% COMP	01121	RCR07G222JS
R36	74702	RESISTOR 1.0K OHM 1/4W 5% COMP	01121	RCR07G102JS
R37	74675	RESISTOR 100 OHM 1/4W 5% COMP	01121	RCR07G101JS
R38	74675	RESISTOR 100 OHM 1/4W 5% COMP	01121	RCR07G101JS
R39	75551	RESISTOR 10 OHM 1/4W 5% COMP	01121	RCR07G100JS
R40	78931	RESISTOR 4.99K OHM RN55C 1% MTL FLM		RN55C4991F
R41	78931	RESISTOR 4.99K OHM RN55C 1% MTL FLM		RN55C4991F
R42	78931	RESISTOR 4.99K OHM RN55C 1% MTL FLM		RN55C4991F
R43	78934	RESISTOR 15.0K OHM RN55C 1% MTL FLM		RN55C1502F
R44	84883	POT 1K OHM 1/2W CERMET 20T PC MT 3/8 SC	73138	66WR1K
R45	78934	RESISTOR 15.0K OHM RN55C 1% MTL FLM		RN55C1502F
R46	86265	RESISTOR 1.00 MEG RN55C 1% MTL FLM		RN55C1004F
R47	78931	RESISTOR 4.99K OHM RN55C 1% MTL FLM		RN55C4991F
R48	84612	RESISTOR 4.75K OHM RN55C 1% MTL FLM		RN55C4751F
R49	84882	POT 500 OHM 1/2W CERMET 20T PC MT 3/8 SQ	73138	66WR500
R50	80193	RESISTOR 12.1K OHM RN55C 1% MTL FLM		RN55C1212F
R51	83099	RESISTOR 1.30K OHM RN55C 1% MTL FLM		RN55C1301F
R52	86955	POT 100 OHM 1/2W CERMET 20T PC MT 3/8 SQ		66WR100
R53	83931	RESISTOR 33.2K OHM RN55C 1% MTL FLM		RN55C3322F
R54	79867	RESISTOR 324 OHM RN55C 1% MTL FLM		RN55C3240F
R55	86956	POT 20 OHM 1/2W CERMET 20T PC MT 3/8 SQ		66WR20
R56	83429	RESISTOR 332K OHM RN55C 1% MTL FLM		RN55C3323F
R57	79867	RESISTOR 324 OHM RN55C 1% MTL FLM		RN55C3240F
R58	86956	POT 20 OHM 1/2W CERMET 20T PC MT 3/8 SQ		66WR20
R59	84882	POT 500 OHM 1/2W CERMET 20T PC MT 3/8 SQ	73138	66WR500
R60	79011	RESISTOR 2.49K OHM RN55C 1% MTL FLM		RN55C2491F
R61	80193	RESISTOR 12.1K OHM RN55C 1% MTL FLM		RN55C1212F
R62	83898	RESISTOR 2.15K OHM RN55C 1% MTL FLM		RN55C2151F
R63	83941	RESISTOR 71.5K OHM RN55C 1% MTL FLM		RN55C7152F
R64	74714	RESISTOR 3.3K OHM 1/4W 5% COMP	01121	RCR07G332JS
R65	86954	POT 200 OHM 1/2W CERMET 20T PC MT 3/8 SQ		66WR200
R66	79743	RESISTOR 750 OHM RN55C 1% MTL FLM		RN55C7500F
R67	80207	RESISTOR 44.2K OHM RN55C 1% MTL FLM		RN55C4422F
R68	76907	RESISTOR 825 OHM RN55C 1% MTL FLM		RN55C8250F
R69	80386	RESISTOR 274K OHM RN55C 1% MTL FLM		RN55C2743F
R70	74714	RESISTOR 3.3K OHM 1/4W 5% COMP	01121	RCR07G332JS
R71	86955	POT 100 OHM 1/2W CERMET 20T PC MT 3/8 SQ		66WR100
R72	79122	RESISTOR 280 OHM RN55C 1% MTL FLM		RN55C2800F
R73	83952	RESISTOR 162K OHM RN55C 1% MTL FLM		RN55C1623F
R74	79123	RESISTOR 301 OHM RN55C 1% MTL FLM		RN55C3010F
R75	86265	RESISTOR 1.00 MEG RN55C 1% MTL FLM		RN55C1004F
R76	74714	RESISTOR 3.3K OHM 1/4W 5% COMP	01121	RCR07G332JS
R77	74714	RESISTOR 3.3K OHM 1/4W 5% COMP	01121	RCR07G332JS
R78	74714	RESISTOR 3.3K OHM 1/4W 5% COMP	01121	RCR07G332JS
R79	74733	RESISTOR 18K OHM 1/4W 5% COMP	01121	RCR07G183JS
R80	74733	RESISTOR 18K OHM 1/4W 5% COMP	01121	RCR07G183JS
R81	74733	RESISTOR 18K OHM 1/4W 5% COMP	01121	RCR07G183JS
R82	74733	RESISTOR 18K OHM 1/4W 5% COMP	01121	RCR07G183JS
S01		NOT ASSIGNED		
S02	86957	SWITCH SLIDE SPDT PC MT		24-220-020
U01	84333	IC OP AMP PRECISION LOW NOISE	12040	LH0044BH
U02	81901	IC OP AMP FET INPUT TO-5 INT.COMP-25+85C	12040	LH0042CH
U03	84333	IC OP AMP PRECISION LOW NOISE	12040	LH0044BH
U04		NOT ASSIGNED		
U05	84333	IC OP AMP PRECISION LOW NOISE	12040	LH0044BH
U06	78977	IC OP AMP GEN.PUR.TO-5 INT.COMP+70C 741C	04713	MC1741CG
U07	78977	IC OP AMP GEN.PUR.TO-5 INT.COMP+70C 741C	04713	MC1741CG
U08	84333	IC OP AMP PRECISION LOW NOISE	12040	LH0044BH
U09	86959	IC QUAD DIFF COMPARATOR		MLM1394L

MODEL 1587 DCA PWB ASSY

REF DESIG PREFIX A02

COMP DESIG	S-A PART NO	DESCRIPTION	FSCM	MFR PART NO
U10	85943	IC TTL DECODER/DEMULTIPLEXER 3-TO-8 LINE		SN74LS138N
U11	84830	IC TTL QUAD D-TYPE FLIP FLOP WITH CLEAR	01295	SN74LS175N
U12	85005	RESISTOR NETWORK 8 2.7K OHM 2% 16 DIP	80294	4116R-001-272
U13	83240	IC QUAD DIFF COMPARATOR	12040	LM339N
U14	84515	RESISTOR NETWORK 8 10K OHM 2% 16 DIP	80294	4116R-001-103

FSCM MANUFACTURER CROSS REFERENCE

FSCM	----------MANUFACTURER----------	----CITY----	STATE
01121	ALLEN-BRADLEY CO	MILWAUKEE	WISC
01295	TEXAS INSTRUMENTS INC	DALLAS	TEXAS
02660	AMPHENOL CORP	BROADVIEW	ILL
04713	MOTOROLA SEMICONDUCTOR PDTS	PHOENIX	ARIZ
12040	NATIONAL SEMICONDUCTOR CORP	DANBURY	CONN
14655	CORNELL-DUBILIER ELEC CORP	S PLAINFIELD	NJ
31718	FAIRCHILD MICROWAVE PRODUCTS	MOUNTAIN VIEW	CALIF
71590	CENTRALAB	MILWAUKEE	WISC
72982	ERIE RESISTOR CORP	ERIE	PA
73138	HELIPOT-DIV BECKMAN INSTR	FULLERTON	CALIF
80183	SPRAGUE PDTS CO	CHICAGO	ILL
80294	BOURNS LABORATORIES INC	RIVERSIDE	CALIF
80368	SYLVANIA ELECTRIC PDTS INC	NEW YORK	NY

CHAPTER 7
DIAGRAMS

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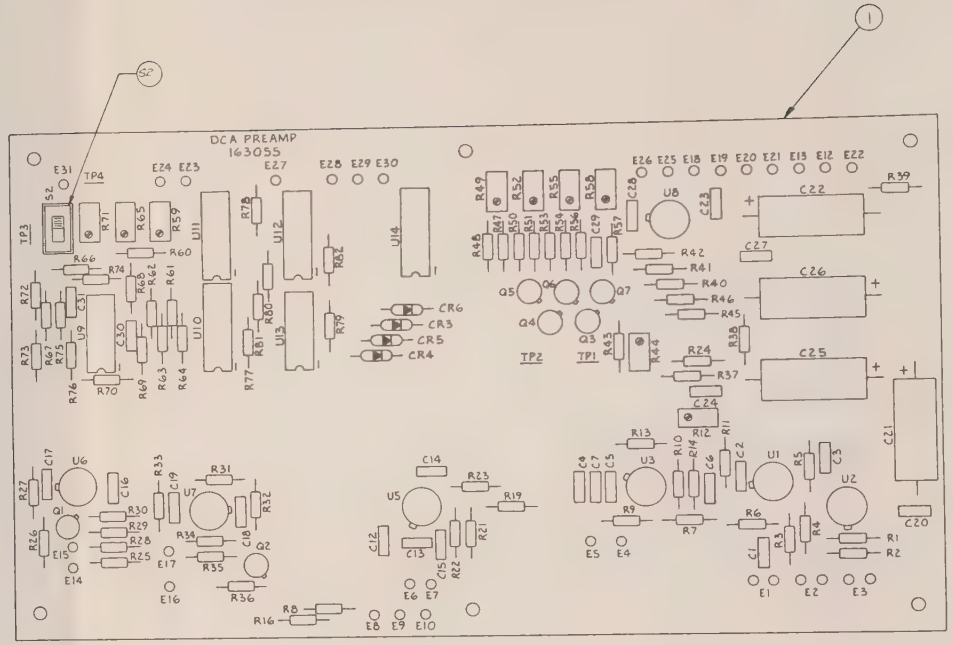


NOTE:
1. REFERENCE SYMBOLS NOT USED ARE C8, C9, C10, C11, CR1, CR2, R15, R17, R18, R20, S1, U4, & E11.

Figure 7-1. Model 1587 DC Amplifier, Printed Circuit Board, Component Location

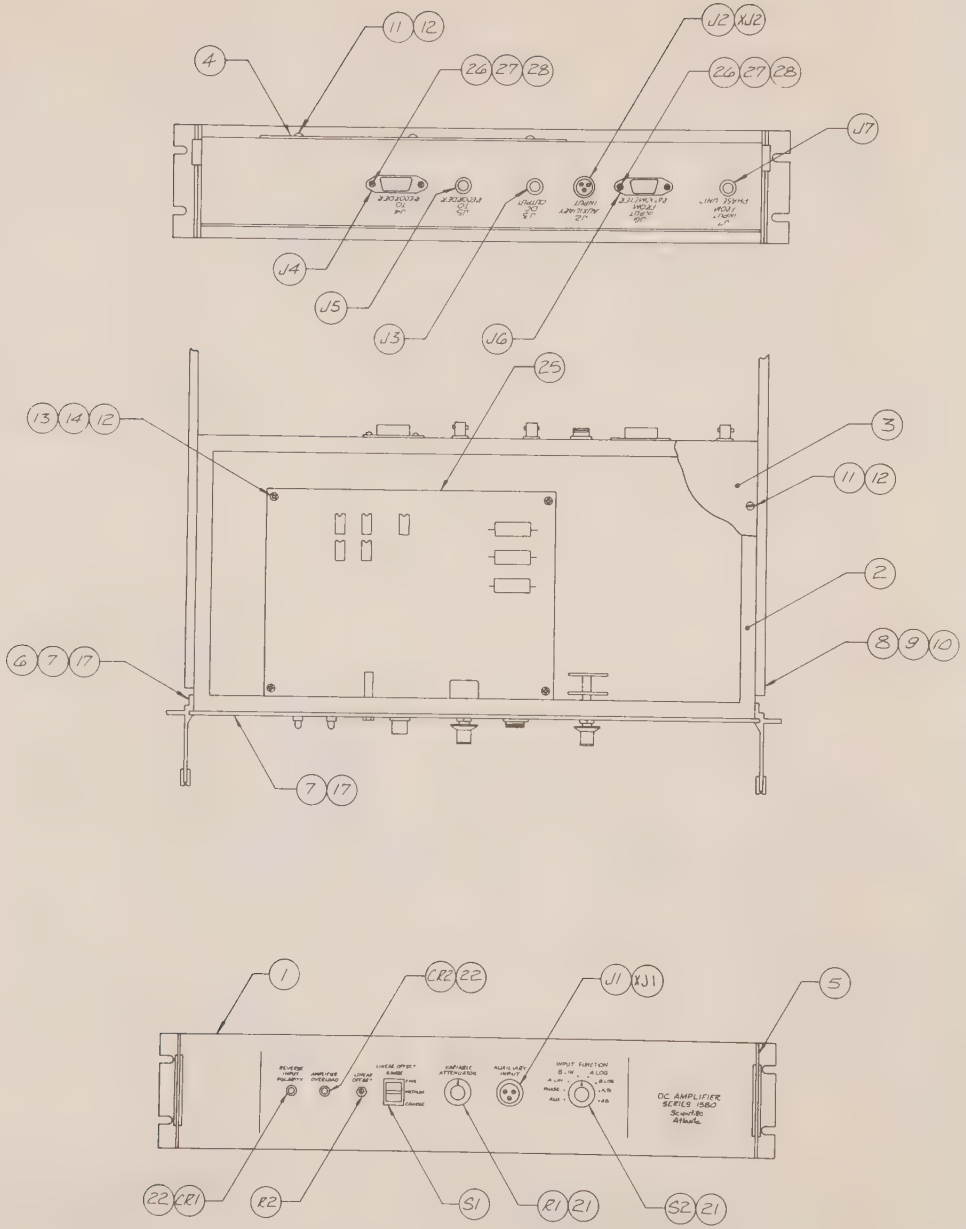
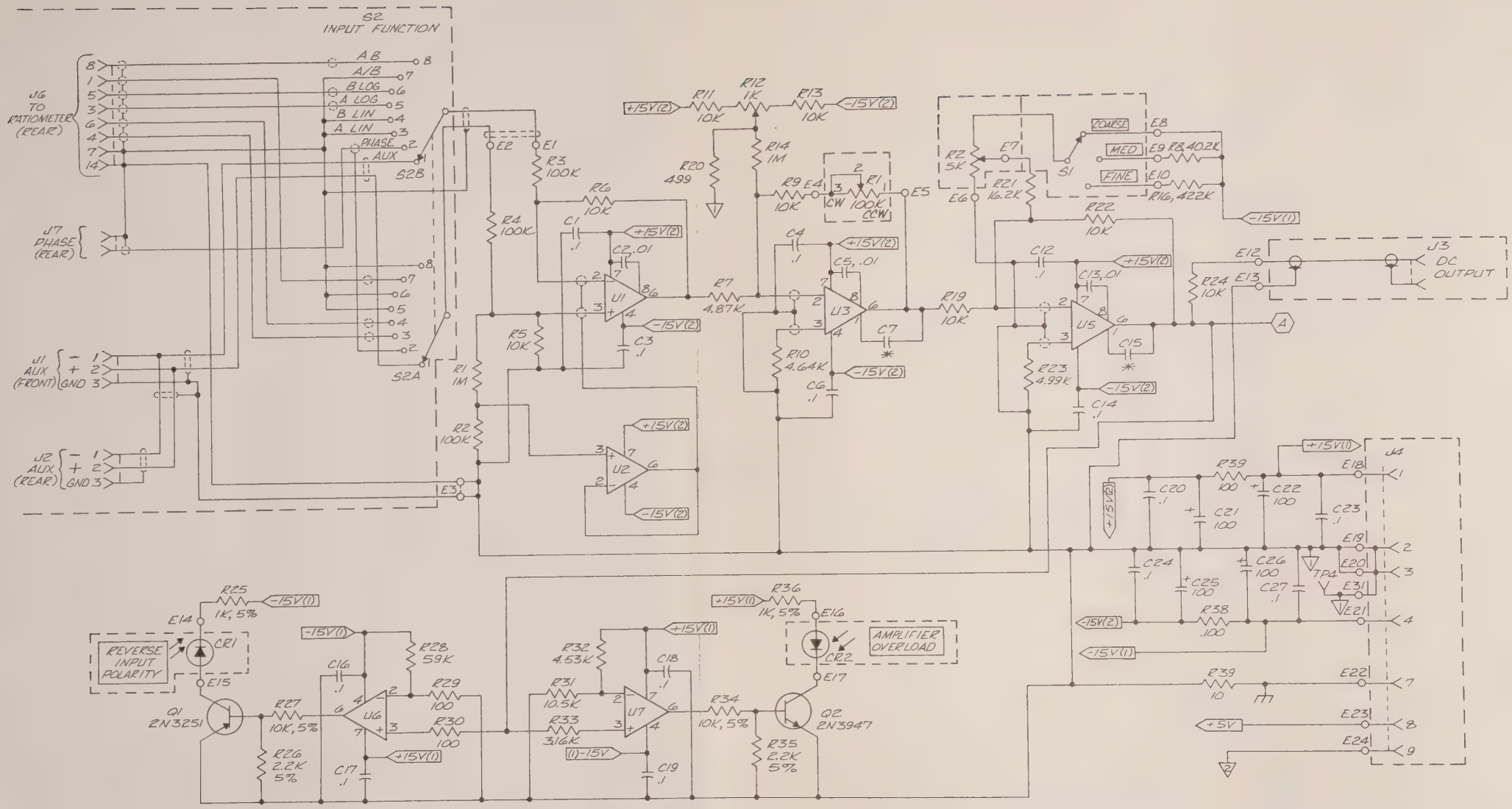


Figure 7-2. Model 1587 DC Amplifier Assembly Layout Drawing



IC	TYPE
U1	LH0044BH
U2	LH0042CH
U3,U5	LH0044BH
U6,U7	741C
U8	LH0044BH
U9	MLM139AL
U10	SN74LS138N
U11	SN74LS175N
U12	411GR001-272
U13	LM 339N
U14	411GR-001-103

NOTE:
1. * FACTORY SELECT.
2. REFERENCE SYMBOLS NOT USED. C8, C9, C10, C11, CR1, CR2, R15, R17, R18, R20, U4.
3. ALL RESISTORS ARE IN OHMS ± 1% AND 1/4 WATT UNLESS OTHERWISE SPECIFIED.

Figure 7-3. Model 1587 DC Amplifier, Schematic Diagram (Sheet 1 of 2)

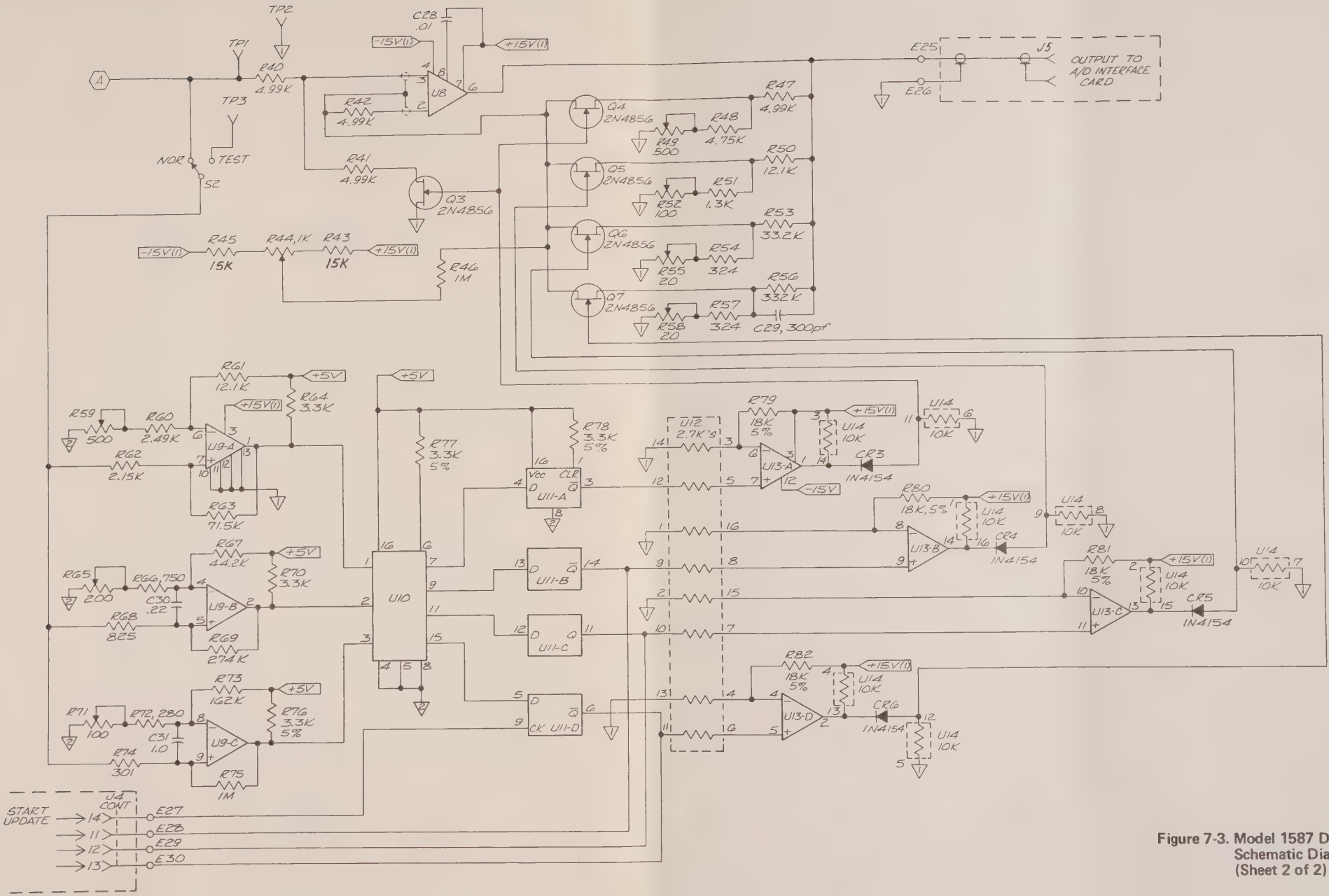


Figure 7-3. Model 1587 DC Amplifier, Schematic Diagram (Sheet 2 of 2)

CONVERSION OF VOLTAGE AND POWER RATIOS TO DECIBELS

The basic chart below indicates the number of decibels (dB) corresponding to the listed ratios of voltage or power over the range of −20 to +20 dB. For voltage or power ratios greater than those included in the chart, the ratio can be broken down into a product of two numbers, the value in dB for each found separately, and the two results added. Example: To convert a power ratio of 2,000:1 to dB, express 2,000\as 2×10^3; the number of dB corresponding to a power ratio of 2 is very nearly 3, and the number of dB for a power ratio of 10^3 is 30. Therefore, the power ratio of 2,000:1 is approximately 30 dB + 3 dB = 33 dB. In the lower righthand corner of the chart dB values for voltage and power ratios of integral powers of 10 are given.

Voltage Ratio	Power Ratio	−dB+	Voltage Ratio	Power Ratio	Voltage Ratio	Power Ratio	−dB+	Voltage Ratio	Power Ratio	Voltage Ratio	Power Ratio	−dB+	Voltage Ratio	Power Ratio
1.000	**1.000**	**0**	**1.000**	**1.000**	**.447**	**.200**	**7.0**	**2.239**	**5.012**	**.200**	**.0398**	**14.0**	**5.012**	**25.12**
.989	.977	.1	1.012	1.023	.442	.195	7.1	2.265	5.129	.197	.0389	14.1	5.070	25.70
.977	.955	.2	1.023	1.047	.437	.191	7.2	2.291	5.248	.195	.0380	14.2	5.129	26.30
.966	.933	.3	1.035	1.072	.432	.186	7.3	2.317	5.370	.193	.0372	14.3	5.188	26.92
.955	.912	.4	1.047	1.096	.427	.182	7.4	2.344	5.495	.191	.0363	14.4	5.248	27.54
.944	.891	.5	1.059	1.122	.422	.178	7.5	2.371	5.623	.188	.0355	14.5	5.309	28.18
.933	.871	.6	1.072	1.148	.417	.174	7.6	2.399	5.754	.186	.0347	14.6	5.370	28.84
.923	.851	.7	1.084	1.175	.412	.170	7.7	2.427	5.888	.184	.0339	14.7	5.433	29.51
.912	.832	.8	1.096	1.202	.407	.166	7.8	2.455	6.026	.182	.0331	14.8	5.495	30.20
.902	.813	.9	1.109	1.230	.403	.162	7.9	2.483	6.166	.180	.0324	14.9	5.559	30.90
.891	**.794**	**1.0**	**1.122**	**1.259**	**.398**	**.159**	**8.0**	**2.512**	**6.310**	**.178**	**.0316**	**15.0**	**5.623**	**31.62**
.881	.776	1.1	1.135	1.288	.394	.155	8.1	2.541	6.457	.176	.0309	15.1	5.689	32.36
.871	.759	1.2	1.148	1.318	.389	.151	8.2	2.570	6.607	.174	.0302	15.2	5.754	33.11
.861	.741	1.3	1.161	1.349	.385	.148	8.3	2.600	6.761	.172	.0295	15.3	5.821	33.88
.851	.724	1.4	1.175	1.380	.380	.145	8.4	2.630	6.918	.170	.0288	15.4	5.888	34.67
.841	.708	1.5	1.189	1.413	.376	.141	8.5	2.661	7.079	.168	.0282	15.5	5.957	35.48
.832	.692	1.6	1.202	1.445	.372	.138	8.6	2.692	7.244	.166	.0275	15.6	6.026	36.31
.822	.676	1.7	1.216	1.479	.367	.135	8.7	2.723	7.413	.164	.0269	15.7	6.095	37.15
.813	.661	1.8	1.230	1.514	.363	.132	8.8	2.754	7.586	.162	.0263	15.8	6.166	38.02
.804	.646	1.9	1.245	1.549	.359	.129	8.9	2.786	7.762	.160	.0257	15.9	6.237	38.90
.794	**.631**	**2.0**	**1.259**	**1.585**	**.355**	**.126**	**9.0**	**2.818**	**7.943**	**.159**	**.0251**	**16.0**	**6.310**	**39.81**
.785	.617	2.1	1.274	1.622	.351	.123	9.1	2.851	8.128	.157	.0246	16.1	6.383	40.74
.776	.603	2.2	1.288	1.660	.347	.120	9.2	2.884	8.318	.155	.0240	16.2	6.457	41.69
.767	.589	2.3	1.303	1.698	.343	.118	9.3	2.917	8.511	.153	.0234	16.3	6.531	42.66
.759	.575	2.4	1.318	1.738	.339	.115	9.4	2.951	8.710	.151	.0229	16.4	6.607	43.65
.750	.562	2.5	1.334	1.778	.335	.112	9.5	2.985	8.913	.150	.0224	16.5	6.683	44.67
.741	.550	2.6	1.349	1.820	.331	.110	9.6	3.020	9.120	.148	.0219	16.6	6.761	45.71
.733	.537	2.7	1.365	1.862	.327	.107	9.7	3.055	9.333	.146	.0214	16.7	6.839	46.77
.724	.525	2.8	1.380	1.905	.324	.105	9.8	3.090	9.550	.145	.0209	16.8	6.918	47.86
.716	.513	2.9	1.396	1.950	.320	.102	9.9	3.126	9.772	.143	.0204	16.9	6.998	48.98
.708	**.501**	**3.0**	**1.413**	**1.995**	**.316**	**.100**	**10.0**	**3.162**	**10.000**	**.141**	**.0200**	**17.0**	**7.079**	**50.12**
.700	.490	3.1	1.429	2.042	.313	.0977	10.1	3.199	10.23	.140	.0195	17.1	7.161	51.29
.692	.479	3.2	1.445	2.089	.309	.0955	10.2	3.236	10.47	.138	.0191	17.2	7.244	52.48
.684	.468	3.3	1.462	2.138	.306	.0933	10.3	3.273	10.72	.137	.0186	17.3	7.328	53.70
.676	.457	3.4	1.479	2.188	.302	.0912	10.4	3.311	10.96	.135	.0182	17.4	7.413	54.95
.668	.447	3.5	1.496	2.239	.299	.0891	10.5	3.350	11.22	.133	.0178	17.5	7.499	56.23
.661	.437	3.6	1.514	2.291	.295	.0871	10.6	3.388	11.48	.132	.0174	17.6	7.586	57.54
.653	.427	3.7	1.531	2.344	.292	.0851	10.7	3.428	11.75	.130	.0170	17.7	7.674	58.88
.646	.417	3.8	1.549	2.399	.288	.0832	10.8	3.467	12.02	.129	.0166	17.8	7.762	60.26
.638	.407	3.9	1.567	2.455	.285	.0813	10.9	3.508	12.30	.127	.0162	17.9	7.852	61.66
.631	**.398**	**4.0**	**1.585**	**2.512**	**.282**	**.0794**	**11.0**	**3.548**	**12.59**	**.126**	**.0159**	**18.0**	**7.943**	**63.10**
.624	.389	4.1	1.603	2.570	.279	.0776	11.1	3.589	12.88	.125	.0155	18.1	8.035	64.57
.617	.380	4.2	1.622	2.630	.275	.0759	11.2	3.631	13.18	.123	.0151	18.2	8.128	66.07
.610	.372	4.3	1.641	2.692	.272	.0741	11.3	3.673	13.49	.122	.0148	18.3	8.222	67.61
.603	.363	4.4	1.660	2.754	.269	.0724	11.4	3.715	13.80	.120	.0145	18.4	8.318	69.18
.596	.355	4.5	1.679	2.818	.266	.0708	11.5	3.758	14.13	.119	.0141	18.5	8.414	70.79
.589	.347	4.6	1.698	2.884	.263	.0692	11.6	3.802	14.45	.118	.0138	18.6	8.511	72.44
.582	.339	4.7	1.718	2.951	.260	.0676	11.7	3.846	14.79	.116	.0135	18.7	8.610	74.13
.575	.331	4.8	1.738	3.020	.257	.0661	11.8	3.890	15.14	.115	.0132	18.8	8.710	75.86
.569	.324	4.9	1.758	3.090	.254	.0646	11.9	3.936	15.49	.114	.0129	18.9	8.811	77.62
.562	**.316**	**5.0**	**1.778**	**3.162**	**.251**	**.0631**	**12.0**	**3.981**	**15.85**	**.112**	**.0126**	**19.0**	**8.913**	**79.43**
.556	.309	5.1	1.799	3.236	.248	.0617	12.1	4.027	16.22	.111	.0123	19.1	9.016	81.28
.550	.302	5.2	1.820	3.311	.246	.0603	12.2	4.074	16.60	.110	.0120	19.2	9.120	83.18
.543	.295	5.3	1.841	3.388	.243	.0589	12.3	4.121	16.98	.108	.0118	19.3	9.226	85.11
.537	.288	5.4	1.862	3.467	.240	.0575	12.4	4.169	17.38	.107	.0115	19.4	9.333	87.10
.531	.282	5.5	1.884	3.548	.237	.0562	12.5	4.217	17.78	.106	.0112	19.5	9.441	89.13
.525	.275	5.6	1.905	3.631	.234	.0550	12.6	4.266	18.20	.105	.0110	19.6	9.550	91.20
.519	.269	5.7	1.928	3.715	.232	.0537	12.7	4.315	18.62	.104	.0107	19.7	9.661	93.33
.513	.263	5.8	1.950	3.802	.229	.0525	12.8	4.365	19.05	.102	.0105	19.8	9.772	95.50
.507	.257	5.9	1.972	3.890	.227	.0513	12.9	4.416	19.50	.101	.0102	19.9	9.886	97.72
.501	**.251**	**6.0**	**1.995**	**3.981**	**.224**	**.0501**	**13.0**	**4.467**	**19.95**	**.100**	**.0100**	**20.0**	**10.000**	**100.00**
.496	.246	6.1	2.018	4.074	.221	.0490	13.1	4.519	20.42					
.490	.240	6.2	2.042	4.169	.219	.0479	13.2	4.571	20.89	10^{-2}	10^{-3}	30		10^{3}
.484	.234	6.3	2.065	4.266	.216	.0468	13.3	4.624	21.38		10^{-4}	40	10^{2}	10^{4}
.479	.229	6.4	2.089	4.365	.214	.0457	13.4	4.677	21.88					
											10^{-5}	50		10^{5}
.473	.224	6.5	2.113	4.467	.211	.0447	13.5	4.732	22.39	10^{-3}	10^{-6}	60	10^{3}	10^{6}
.468	.219	6.6	2.138	4.571	.209	.0437	13.6	4.786	22.91		10^{-7}	70		10^{7}
.462	.214	6.7	2.163	4.677	.207	.0427	13.7	4.842	23.44	10^{-4}	10^{-8}	80	10^{4}	10^{8}
.457	.209	6.8	2.188	4.786	.204	.0417	13.8	4.898	23.99		10^{-9}	90		10^{9}
.452	.204	6.9	2.213	4.898	.202	.0407	13.9	4.955	24.55					
										10^{-5}	10^{-10}	100	10^{5}	10^{10}
											10^{-11}	110		10^{11}
										10^{-6}	10^{-12}	120	10^{6}	10^{12}

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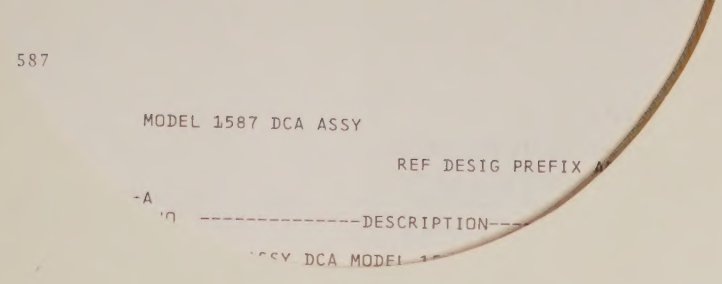

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